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CITY OF BOSTON, MASSACHUSETTS

REPORT ON IMPROVEMENTS TO THE BOSTON MAIN DRAINAGE SYSTEM

VOLUME 2

HUD Project No. P-Mass-3306

SEPTEMBER, 1967

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Camp, Dresser & McKee
Consulting Engineers
Boston, Massachusetts

This is Volume 2 of the "Report on Improvements to the Boston Main Drainage System" and includes the following:

Appendix A	History of the Boston Sewerage System Before 1950
Appendix B	Plan of Existing Sewerage System
Appendix C	Population Trends for Wards
Appendix D	Condition and Capacity of Existing Outlets
Appendix E	Public Boston Connections to the Metropolitan Sewerage System
Appendix F	The Proposed Deep Tunnel Plan
Appendix G	Subsurface Data
Appendix H	Bibliography

The reader is referred to Volume 1 for the complete text, conclusions and recommendations with regard to improvements recommended for the Boston Main Drainage System.

CAMP, DRESSER & McKEE

by

Charles A. Parthum

Charles A. Parthum

APPENDIX A

APPENDIX A

HISTORY OF THE BOSTON SEWERAGE SYSTEM BEFORE 1950

Early History

The first sewer was constructed in Boston prior to the year 1700, some 70 years after Boston was first settled. By 1701, the population had increased to about 8,000, and problems were being created by frequent digging of streets to lay or repair sewers. In 1709, the Massachusetts General Court passed an act regulating the construction of drains and common sewers in Boston and determining the method and distribution of charges for making and repairing the same. For 114 years thereafter (until 1823), the sewers in Boston were constructed, repaired, and owned by private individuals under authority of this 1709 act. The purpose for which the sewers were constructed under this act was for the draining of cellars and lands. Toilet and privy vault wastes were specifically excluded.

One of the firts acts of the City Government in 1823, when Boston was granted its City Charter, was to assume control of all existing sewers and the construction and maintenance of new ones. Thereafter, new sewers were constructed by the City. The City ordinances regulated sewers and required that, when practicable, sewers should be of sufficient size to be entered by work crews for cleaning.

Fecal matter was excluded from the sewers until 1833, when it was provided that the Mayor and Aldermen, at their discretion, might permit connections which would admit such matter to the sewers. To assist in flushing out deposits in the sewers, it was provided, in 1834, that any person might discharge rainwater from his roof into the sewers "without permit or fee."

During the nineteenth century, extensive operations for reclaiming and filling tidal areas bordering the old shorelines of Boston were undertaken. To meet these changing conditions, sewers were extended long distances at slight or no gradient to reach points of discharge into the harbor or its estuaries. As a consequence, sewers were prevented by tidal action from discharging for long periods each day, resulting in the deposit of sludge and debris within the sewers and upon the tidal flats about the City, with attendant health and odor problems.

In 1870, the consulting physicians of the City declared the urgent necessity of a better system of sewerage and in December, 1874, the City Board of Health pointed out clearly the evils of the existing system and strongly urged that a radical change be made.

On March 1, 1875, an order was passed by the City Council authorizing the Mayor to appoint a commission, "consisting of two civil engineers of experience and one competent person skilled in the subject of sanitary science, to report on the present sewerage of the city . . . . and to present a plan for outlets and main lines of sewers for the future wants of the city." This report was submitted in December, 1875.

It listed the following three ways in which the City, at that time, failed to dispose of its sewage before it became an extreme nuisance from putrefaction:

1. Sewage could not always be discharged from house drains to the sewers because the sewers themselves were not only full at high tide, but sewage was even forced backward up the drains into the houses.

2. Sludge deposits formed in the sewers because the tide or tide gates prevented outflow. These deposits remained in some places for many months because not enough velocity was produced, even with a falling tide, to induce scour.

3. Sewage discharged from the outlets was held in the harbor by tidal currents permitting the sewage to "decompose and contaminate the air."

Their report presented three possible methods of disposing of sewage as follows:

1. Precipitation or sedimentation of the solid portions of the sewage.

2. Irrigation.

3. Deep water discharge.

It was the recommendation of the Commission that discharge of the sewage to deep water be adopted.

The Commission specifically proposed two main drainage systems, one for each side of the Charles River. The system on the south side would have its outlet at Moon Island, and on the north side discharge would be at Shirley Gut near Deer Island. Because of opposition to the Commission's recommendations, the City Council adopted the recommendations only insofar as they referred to the territory south of the Charles River. Based on these recommendations, Chapter 136, Acts of 1876, entitled "An Act to Empower the City of Boston to lay, finance, and maintain a main sewer discharging at Moon Island in Boston Harbor and for other purposes," was passed by the Massachusetts Legislature.

Construction after 1876

The City of Boston, from 1877 to 1884, constructed what is known as the Boston Main Drainage System. This system consisted of 25 miles of main and branch intercepting sewers, a pumping station at Calf Pasture, and an outfall sewer in tunnel extending to holding tanks on Moon Island from which the sewage was discharged to the harbor on outgoing tides. Sewers constructed were the Boston Main Interceptor (including a portion of the Stony Brook Sewer), East Side Interceptor, West Side Interceptor (including the Brimmer Street Sewer), and the South Boston Interceptor (south branch). The system was designed to have sufficient capacity to intercept the estimated dry weather flow of sanitary sewage, plus a small allowance for storm water, from combined sewers which formerly had discharged continuously into the harbor and its estuaries.

The North Metropolitan Sewerage District and the Charles River Valley Sewerage Systems were created by Chapter 439, Acts of 1889. The system in the North Metropolitan Sewerage District received sewage from the cities and towns north of the Charles River, including the East Boston and Charlestown sections of Boston, and discharged to Boston Harbor off Deer Island. The Charles River Valley system, serving Brighton and portions of the Back Bay districts of Boston, and areas in towns west of Boston bordering the river, was originally connected to the Boston Main Drainage System at Gainsborough Street. It was included in the South Metropolitan Sewerage District system in 1904. In 1905, the Ward Street Pumping Station was constructed, which lifted the flow from the Charles River Valley Sewer to the South Metropolitan High Level Sewer.

The South Metropolitan Sewerage District was established under the provisions of Chapter 424 of the Acts of 1899, to provide an outlet for the sewage from portions of the Charles River Valley, the Neponset River Valley, and adjacent areas south of the Boston Main Drainage System. Works for the diversion of the sewage from this district into Boston Harbor were first placed in use in 1904. The Neponset River Valley Sewer between Central Avenue and Granite Avenue was originally designed and built by the City in about 1900 and subsequently purchased by the Metropolitan District Commission. Flows from upstream portions of the Neponset River Valley Sewer were diverted into the MDC South Metropolitan High Level Sewer at Monponsett Street. The downstream portion carries dry weather flows from Monponsett Street. At Granite Avenue this sewer discharges to the Dorchester Interceptor in the Boston Main Drainage System.

The Boston Marginal Conduit was built between the south bank of the Charles River Basin and the West Side Interceptor in conjunction with the construction of the dam forming the basin under the Acts of 1903. This conduit provided an outlet to tidewater for polluted storm flows previously tributary to the Charles River Basin.

In the period from about 1867 to 1918, the sewer conduits and channels serving Stony Brook, Muddy River, and the Back Bay Fens were constructed, extended from time to time upstream to further enclose Stony Brook. Upper reaches of Stony Brook have only recently been enclosed.

Subsequent to construction of most of the Boston Main Drainage System described herein, the North Branch of the South Boston Interceptor was built during the period 1882 to 1890, and the Dorchester Brook Sewer and Dorchester Interceptor were constructed during the periods from 1897 to about 1926 and 1887 to 1895, respectively. In the period 1912 to 1915, the pumping station at Union Park Street, together with high and low level sewers, were built to reduce flooding in low-lying areas of the South End. And in 1916 the Canal Street Relief Sewer was constructed to divert sewage from portions of downtown Boston, from the West Side Interceptor to the East Side Interceptor.

Following the completion of the Boston Main Drainage System, few changes in the system, except those of a local nature, have occurred up to the present time. A description of the system as it now exists is given in Chapter III of this report.

Developments from 1900 to 1950

Since the construction of the principal portions of the Boston Main Drainage System, the discharge of sewage into Boston Harbor, the Charles River Basin, and South Bay has been investigated a number of times by direction of the Massachusetts Legislature. Several important investigations include those made in 1900 by the State Board of Health on the discharge of sewage into Boston Harbor, in 1903 by the Committee on Charles River Dam, in 1915 by a Joint Board, in 1917 by the Metropolitan Water and Sewerage Board, the Commissioner of Health of the State Department of Health and the Commissioner of Public Works in the City of Boston acting jointly, in 1929 and 1930 by special commission, relative to the discharge of sewage into Boston Harbor, and in 1935 and 1936 by a special commission.

The report of 1936 (House Document 1600) was authorized under the provisions of Chapter 42 of the Resolves of 1935, and extended by Chapters 5 and 36 of the Resolves of 1936. The special commission consisted of the State Commissioners of Public Works and Public Health, the Commissioners of the Metropolitan District Commission, and the Health Commissioner and Commissioner of Public Works of the City of Boston, acting jointly. This special commission recommended:

"1. That special engineering studies be made and plans prepared under the supervision of the Department of Public Works of the City of Boston and the Metropolitan District Commission, with a view to providing adequate works for separating storm water from the domestic sewage in their respective systems and to providing adequate carrying capacity in all parts of the systems to prevent the overflow of domestic sewage and industrial wastes in the harbor or its tributaries.

2. That suitable devices be provided by the Metropolitan District Commission for measuring the flow of sewage entering the sewerage systems of the North and South Metropolitan Sewerage districts from each city and town in the districts, and that consideration be given to amending Chapter 92 of the Tercentenary Edition of the General Laws to provide for assessing the cities and towns of North and South Metropolitan Sewerage districts according to the quantity of sewage discharged from each municipality into the North and South Metropolitan Sewerage systems.

3. That new legislation be enacted to provide for compulsory construction or reconstruction of sewers, drains, channels, pumping stations and other works for preventing surface or storm water or other water, within the meaning of Section 9 of Chapter 92 of the Tercentenary Edition of the General Laws, from entering the Boston Main Drainage and the North and South Metropolitan Sewerage systems.

4. That public bathing along the water front of Boston Harbor and its estuaries and tributaries be prevented, except at such point or points as may meet with the approval of the Board of Health of the city or town in which such bathing sites are located or with the approval of the Department of Public Health.

5. That consideration be given to the preparation of detail plans for the treatment and disposal of sewage from the Boston Main Drainage District and the North and South Metropolitan Sewerage districts before it is discharged into Boston Harbor, and that such plans consider the possible extension in the near future of the Boston Main Drainage outlet to a point in deep water, and all of these outlets in the distant future, if necessary, to a point near the Graves for the disposal of the treated sewage. With plans available, it would be possible for these works to be constructed with the least possible delay should the public health or the demands of the population interested require.

6. That consideration be given by planning boards of the cities and towns in the vicinity of Boston Harbor to the possible construction of sewage treatment works in the future as herein described at Deer Island, Nut Island and Moon Island, with possible additional works at these locations for incinerating the sludge and other objectionable matter removed from the sewage."

This investigation did not show the condition of Boston Harbor to be such as to result in a nuisance, except in the immediate vicinity of the main sewer outlets and at certain sewer overflows to streams and estuaries, but did show that certain shores of the harbor and banks of certain tributary streams are seriously polluted at times by the overflow of sewage from storm water outlets; also, that under certain tide and wind conditions floating matter characteristic of sewage reaches adjacent shores used for bathing. Investigation also showed that objectionable conditions due to the overflow of sewage into tributary streams along the waterfront of Boston Harbor are due to the inability of the sewerage systems to dispose of the large amounts of storm water with the sanitary sewage entering these systems at times of considerable runoff.

In 1938 and 1939, an investigation and report (House Document 2465 of 1939) was made by a special commission with the aid of consulting engineers, in response to Chapter 79, Resolves of 1938. The major recommendations of this report which affected the City of Boston were the construction of a storm overflow conduit on the south side of the Charles River with pumping station at Berkeley Street, a Stony Brook relief sewer, a sewage pumping station discharging to the East Side Interceptor of the Boston Main Drainage System to serve the East Concord Street district, and sewage treatment plants at Nut, Moon and Deer Islands, essentially as recommended in House Document 1600.

Pollution of the Charles River, including the Basin, was covered in a report issued as House Document 1961 of 1939. This report was made by a Joint Board, consisting of the Metropolitan District Commission and the Massachusetts Department of Public Health. The report stated that "if the purposes for which the (Charles River) basin is constructed are to be carried out, then the overflow of large volumes of sewage into this basin must be prevented, ..." Recommended improvements affecting Boston were:

1. A new Charles River Valley sewer and pumping station in Brighton to pump sewage into the High Level Sewer.

2. Extension of the Boston Marginal Conduit upstream to Brighton.

3. Pumping station and facilities for lower end of the Boston Marginal Conduit.

In January 1941, a preliminary engineering Report on "Sewerage and Sewage Disposal Studies under Chapter 512, 1939" was submitted to the Metropolitan District Commission. This detailed report recommended the construction of a sewage treatment plant and pumping station at Nut Island, a storm overflow conduit along the south bank of the Charles River as proposed in House No. 2465, and the North Metropolitan Relief Tunnel.

Chapter 705, Acts of 1945, included authorization for the construction of the Nut Island Sewage Treatment Plant, serving the South Metropolitan Sewerage District. This plant was constructed and placed in operation in 1952. This Act also authorized the construction of the North Metropolitan Relief Tunnel, a pumping station at East Boston, investigations, borings, designs, plans, and specifications only of the Deer Island Sewage Treatment Plant to serve the North Metropolitan Sewerage District, and construction of a storm overflow conduit on the south side of the Charles River. A bond issue of $15,000,000 was authorized to finance this work. An additional $8,000,000 was authorized for this work by Chapter 595, Acts of 1947.

In 1948, a report was made to the Metropolitan District Commission by Metcalf and Eddy, Engineers, which discussed earlier engineering studies of a "Comprehensive Plan for the Relief of Storm Overflows into Charles River Basin and Extension of North Metropolitan Relief Sewer from East Boston to Deer Island." This report, together with the earlier studies, supported the proposed "Comprehensive Plan" of the Metropolitan District Commission, which was studied in the 1950 and 1951 engineering reports by Charles A. Maguire and Associates, as discussed in Chapter X of this report.

An additional $25,000,000 was authorized under Chapter 606, Acts of 1949, for completing the construction authorized under Chapter 705 of 1945, and constructing the Deer Island Sewage Treatment Plant and the storm overflow conduit on the south side of the Charles River.

In reports submitted by Camp, Dresser & McKee to the "Joint Board Relative to the Disposal of Sewage in the South Metropolitan Sewerage District. . . ." in 1948 and 1949 as House Documents Nos. 2151 and 2263, respectively, it was recommended that relief of the South Metropolitan High Level Sewer be provided by the diversion of the Charles River Valley System into the North Metropolitan System . . . ."

Under the provisions of Chapter 598, Acts of 1949, the City of Boston was authorized to construct a sewage treatment plant at the site of the Calf Pasture Pumping Station, and to reconstruct and alter the existing sewerage works at Calf Pasture and Moon Island. Boston was authorized to borrow up to $15,000,000 for these purposes. This legislation was repealed by Chapter 645, Acts of 1951.

Investigations, legislation, and construction undertaken since 1950, which affect the City of Boston, are discussed in Chapter II of this report under "History of the Boston Sewerage System Since 1950."

APPENDIX B

CITY OF BOSTON, MASSACHUSETTS

PLAN OF EXISTING SEWERAGE SYSTEM

LEGEND

Sheets (1) through (17)

Existing City of Boston Sewers
- Change in Size, Shape and/or Material
- Sanitary Sewer
- Storm Drain
- Combined Sewer
- Regulating Structure
- Tide Gate
- Siphon Chambers

Existing M.D.C. Sewers

Sewer Shapes
- Circular
- Rectangular
- Egg
- Oval
- Ovoid
- Horseshoe
- U-Shaped
- Arch Sewer Bottom
- Modified Circle
- Catenary
- Unknown

Sewer Materials
- Clay
- Concrete
- Reinforced Concrete
- Brick
- Brick and Wood
- Wood
- Brick and Stone
- Stone
- Cast Iron
- Iron

Conduit Outlets
- ● Combined Sewer
- ● Storm Drain

NOTES.
1. All sewer dimensions shown in inches unless otherwise indicated.
2. All dimensions are maximum internal width by maximum internal height, except for circular sewers for which only the internal diameters are shown.
3. Figures shown thus - (1) through (17) - represent sheet numbers for drawings comprising the Plan of Existing Sewerage System.

CITY OF BOSTON
KEY MAP

CAMP, DRESSER & McKEE • CONSULTING ENGINEERS • BOSTON, MASSACHUSETTS

FIG. 4

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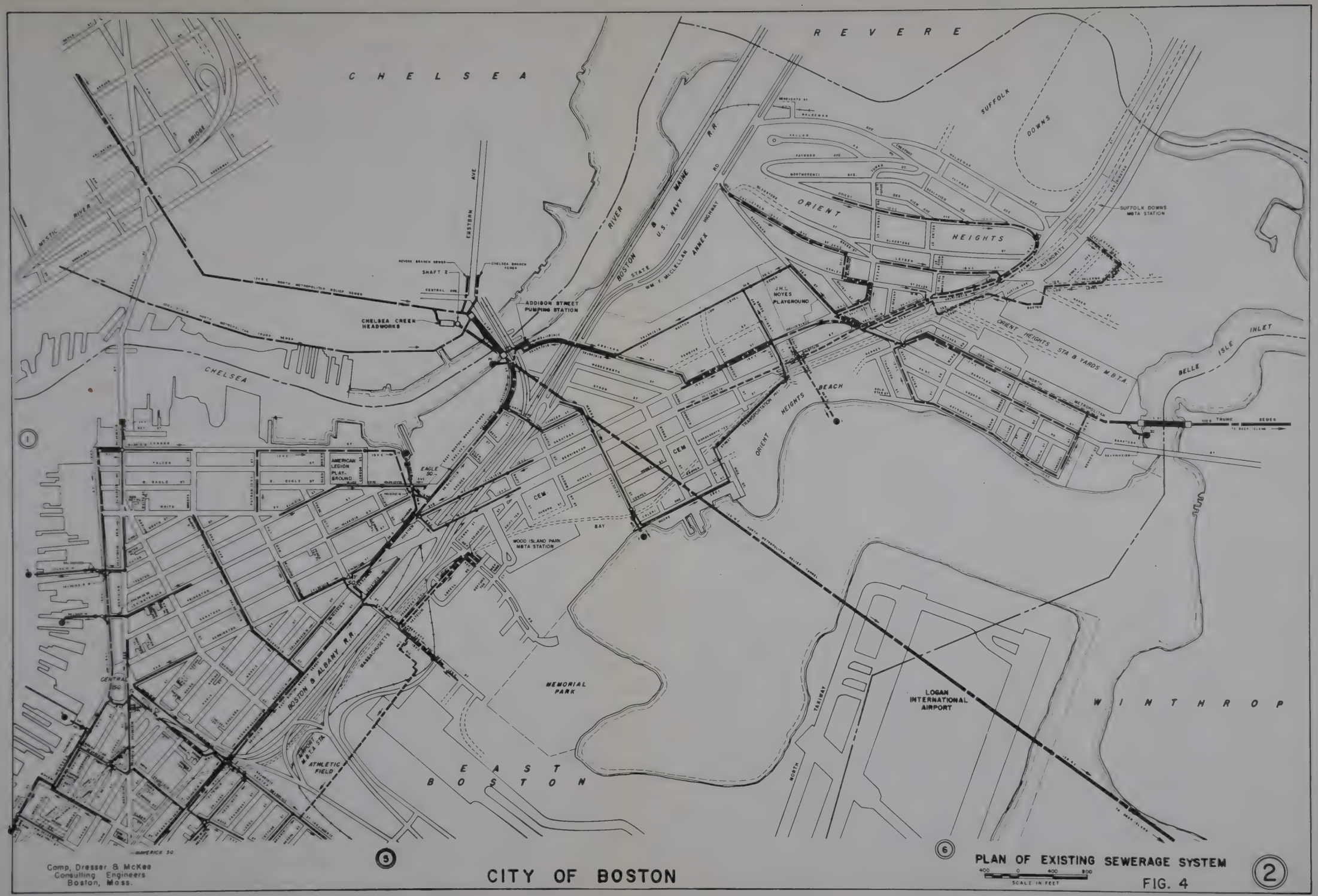
Consulting Engineers
Boston, Mass.

CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4



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Boston, Mass.

CITY OF BOSTON

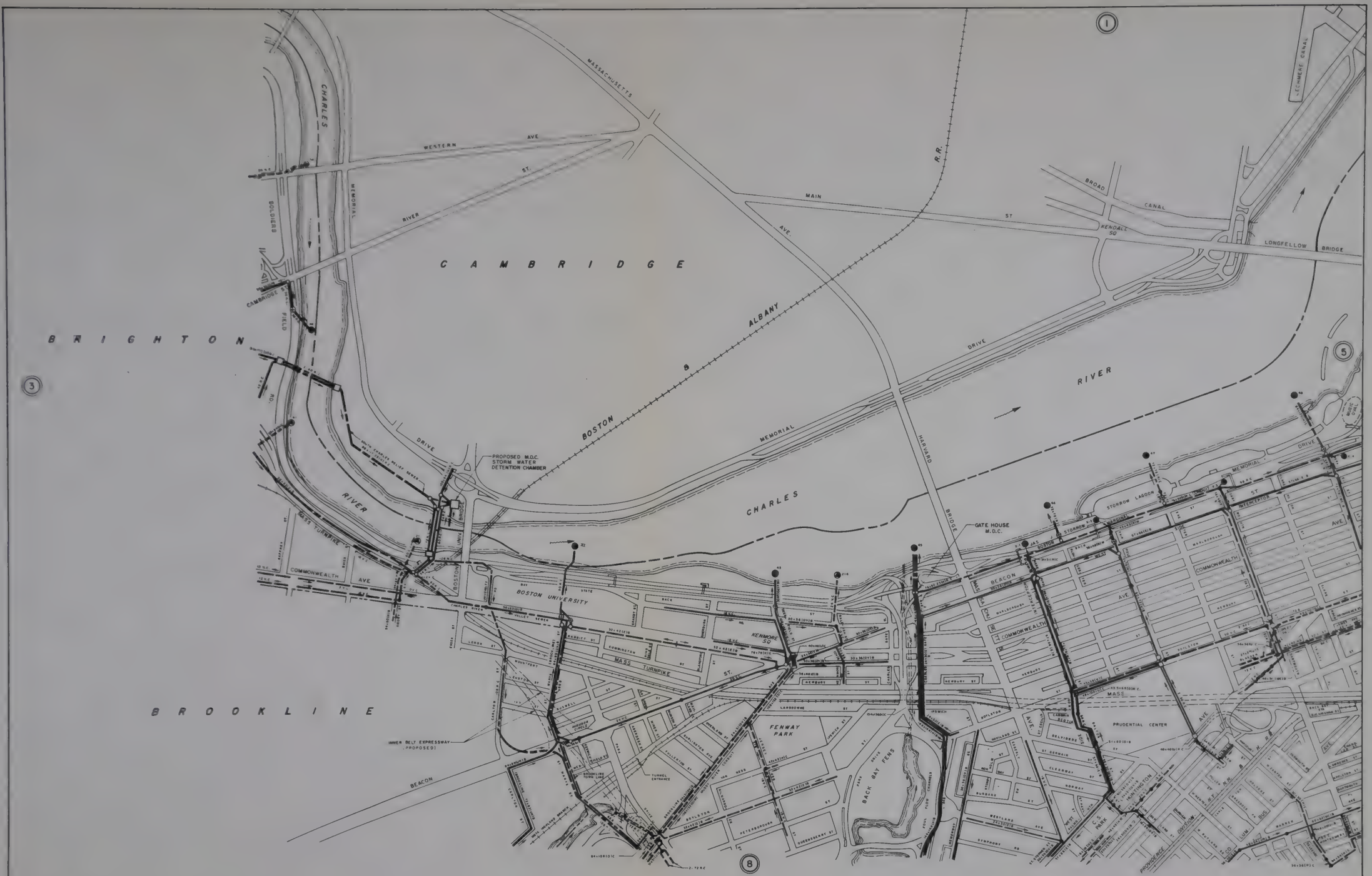
PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

2

CAMBRIDGE
WATERTOWN
BROOKLINE
BOSTON
CHARLES RIVER
CHARLES RIVER BASIN
SOLDIERS FIELD
SOLDIERS FIELD RD
RESERVATION RD
MEMORIAL DRIVE
STORROW DRIVE
MASS TURNPIKE
ALBANY
NORTH BEACON ST
BEACON ST
WESTERN AVE
BRIGHTON AVE
ALLSTON ST
UNION SQ
HARVARD BUSINESS SCHOOL
WILLIAM E. SMITH PLAYGROUND
PORTSMOUTH ST PLAYGROUND
McKINNEY PLAYGROUND
STANLEY A RINGER PLAYGROUND
BOSTON UNIVERSITY FIELD
WASHINGTON
ROGERS PK
BRIGHTON
ALLSTON
Camp, Dresser & McKee
Consulting Engineers
Boston, Mass.
CITY OF BOSTON
PLAN OF EXISTING SEWERAGE SYSTEM
400 0 400 800
SCALE IN FEET
FIG. 4
3
4
7



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Consulting Engineers
Boston, Mass.

CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

4

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Boston, Mass

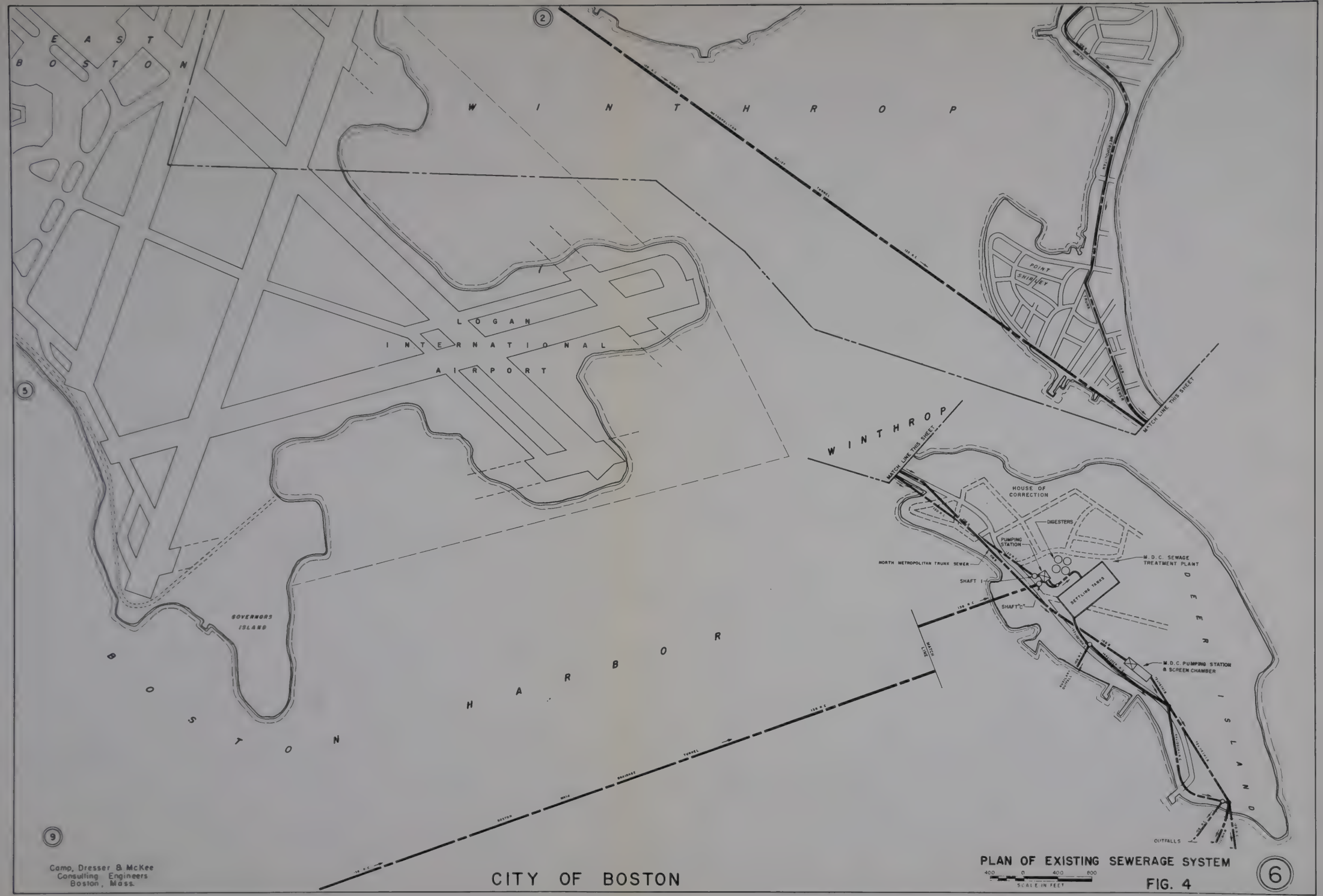
CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

5



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CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

6

CHANDLER'S POND
ST JOHN'S SEMINARY
PLAYGROUND
EVERGREEN CEMETERY
COMMONWEALTH AVE
BOSTON COLLEGE
CHESTNUT HILL RESERVOIR
CHESTNUT HILL PARK
BEACON ST
BEACON
WASHINGTON
NEWTON
BROOKLINE
TRANSPORTATION AUTHORITY
MASSACHUSETTS
BOYLSTON
HIGHLAND BRANCH
SEWER
CITY OF BOSTON
PLAN OF EXISTING SEWERAGE SYSTEM
SCALE IN FEET
FIG. 4
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Boston, Mass.

Notes:

1. West barrel of Old Stony Brook conduits not shown in Columbus Avenue between Centre Street and Cedar Street. This barrel is used as a combined sewer overflow connection to Stony Brook Conduit.
2. Muddy Brook culverts from Jamaica Pond not shown.

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CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

8

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CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

9

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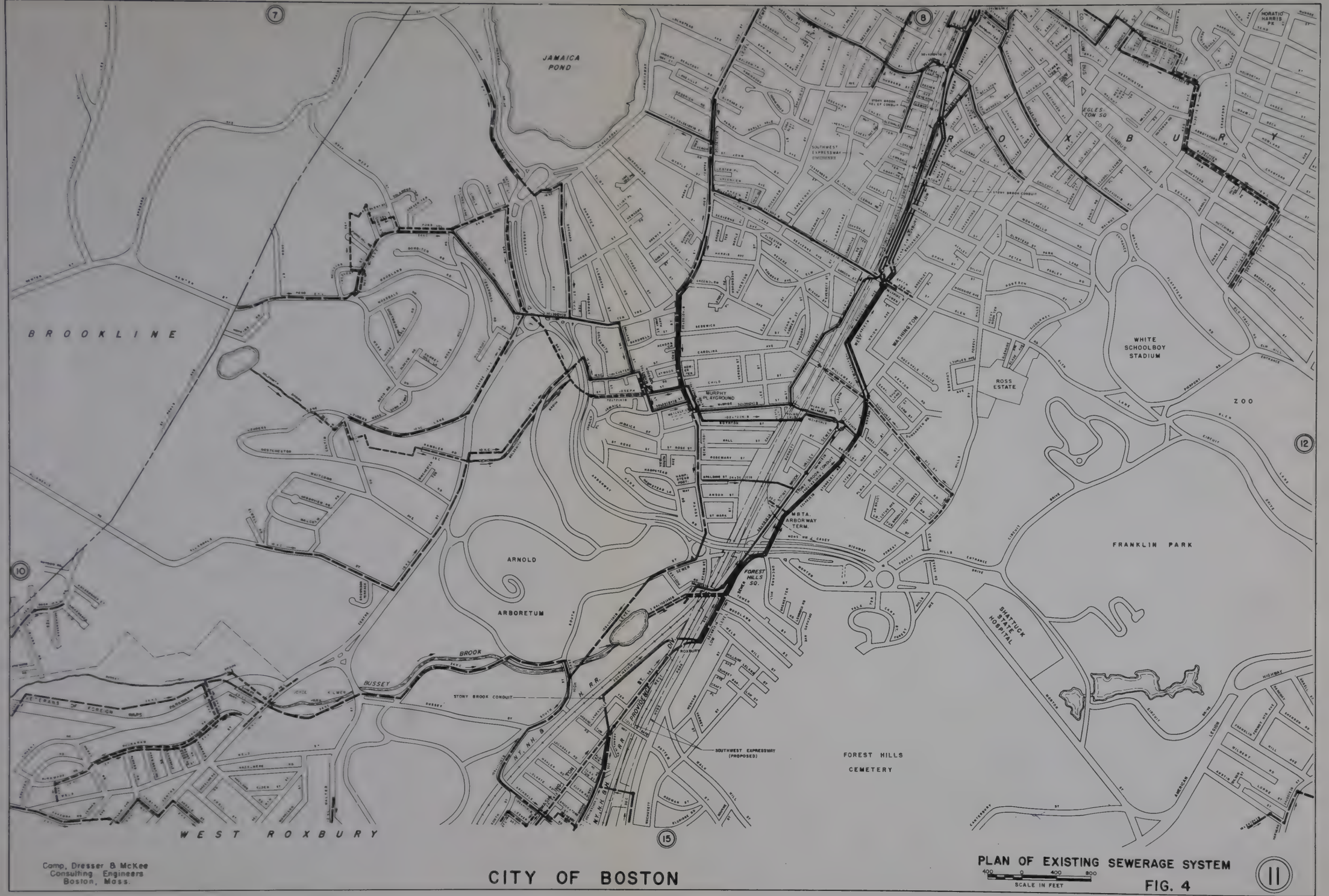
CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

10



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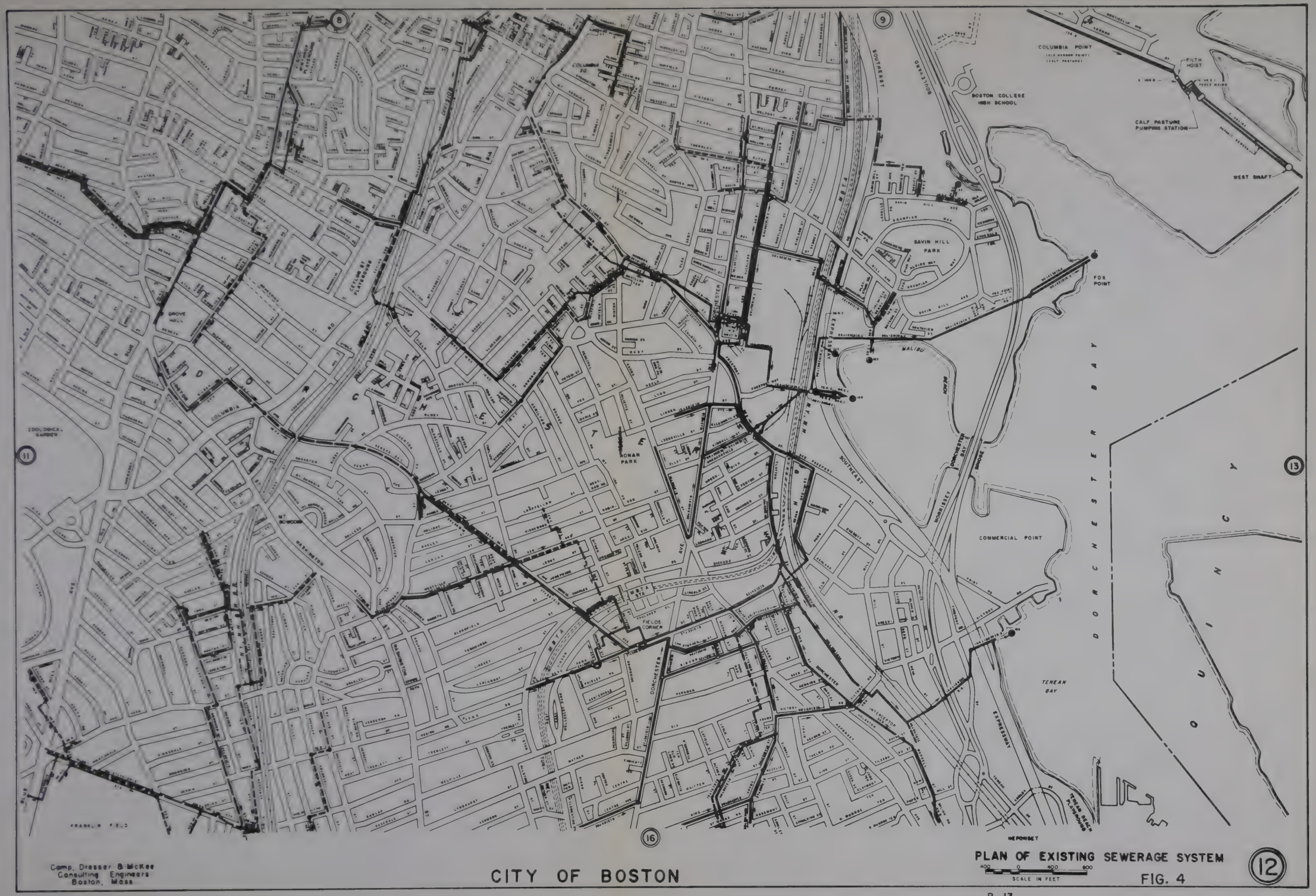
CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

11



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Boston, Mass.

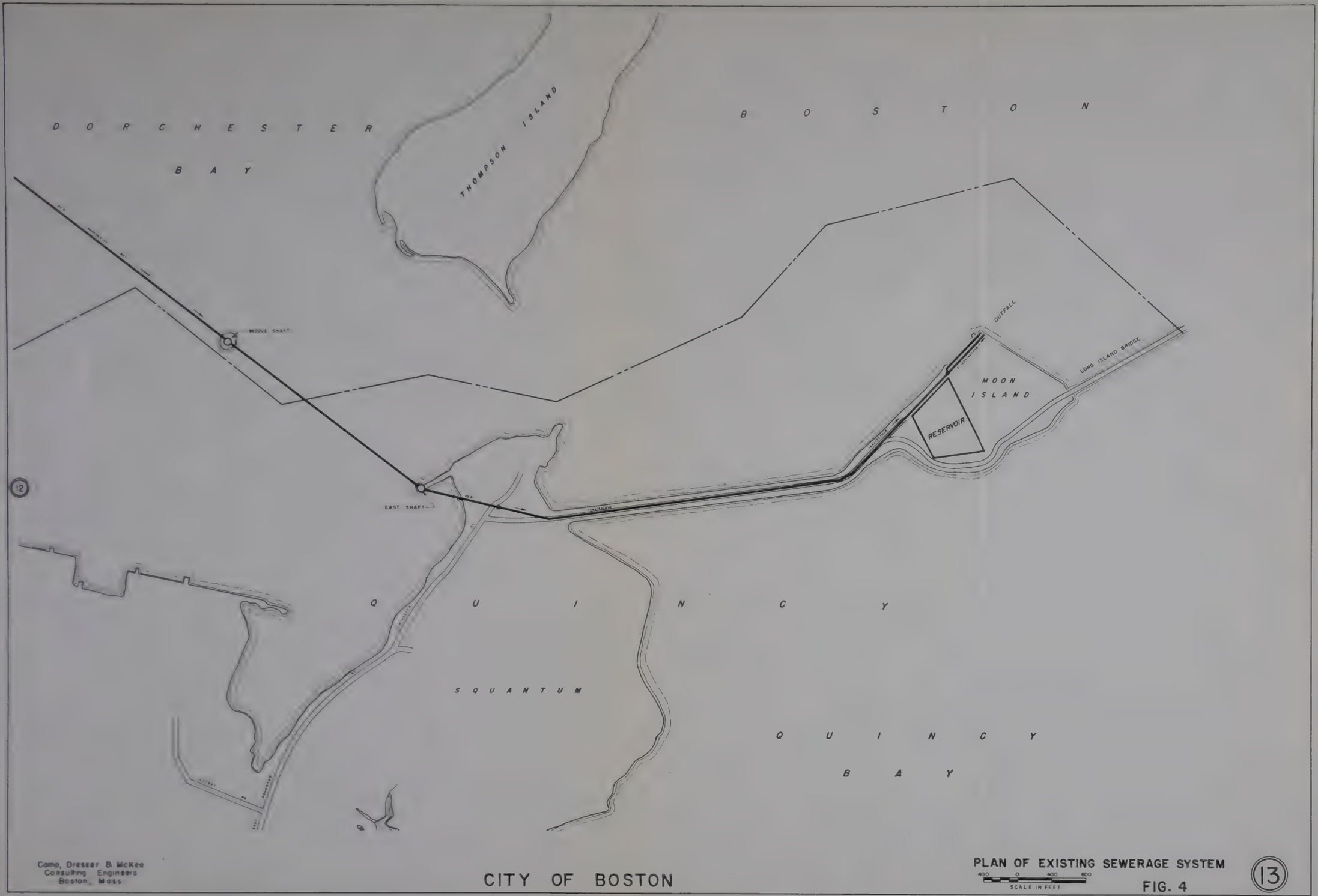
CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

12



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Boston, Mass

CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

13

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CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

14

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CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

15

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CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

16

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Boston, Mass.

CITY OF BOSTON

PLAN OF EXISTING SEWERAGE SYSTEM

400 0 400 800
SCALE IN FEET

FIG. 4

APPENDIX C

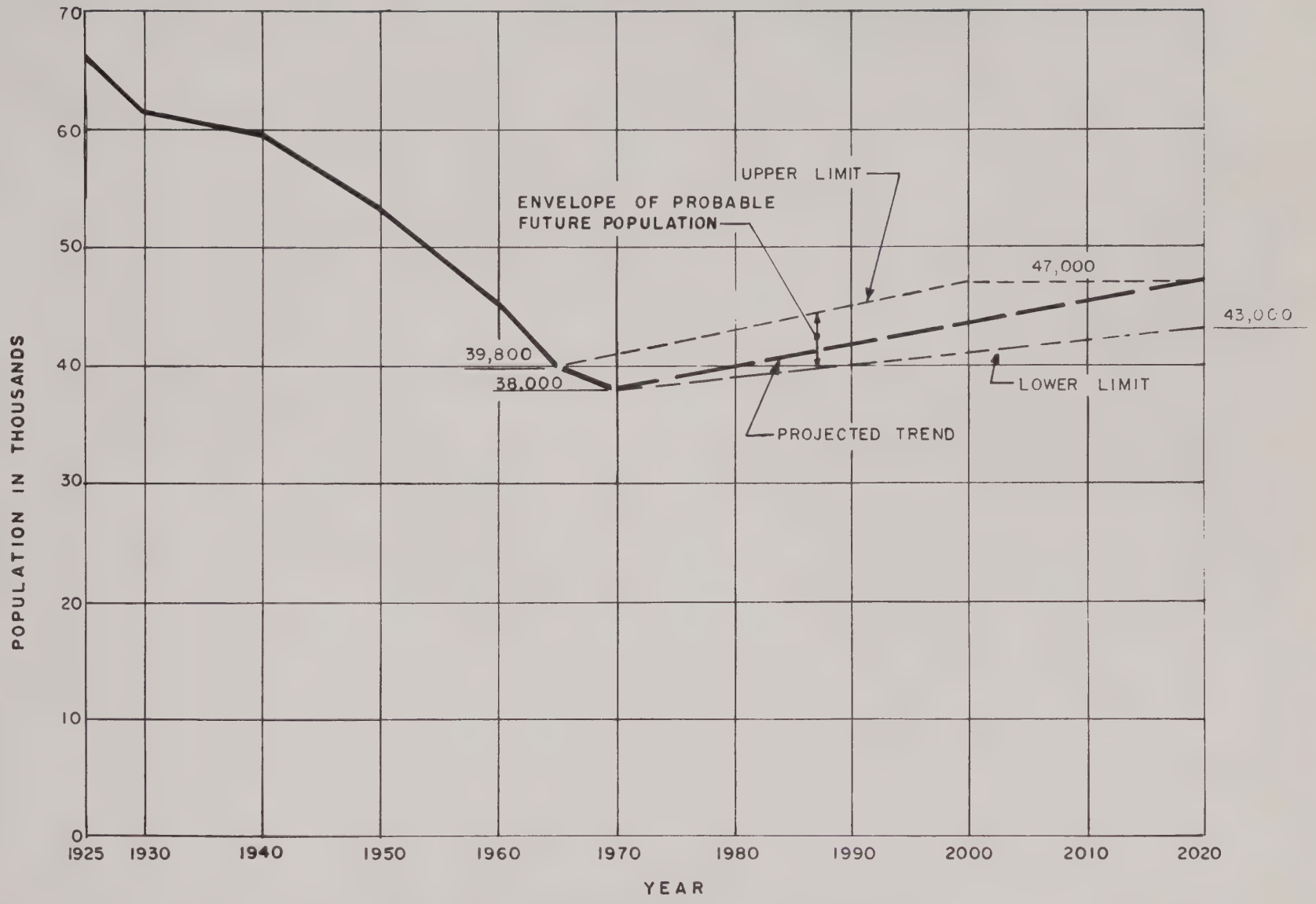


FIG. 7 POPULATION TRENDS FOR WARD I

257-8353

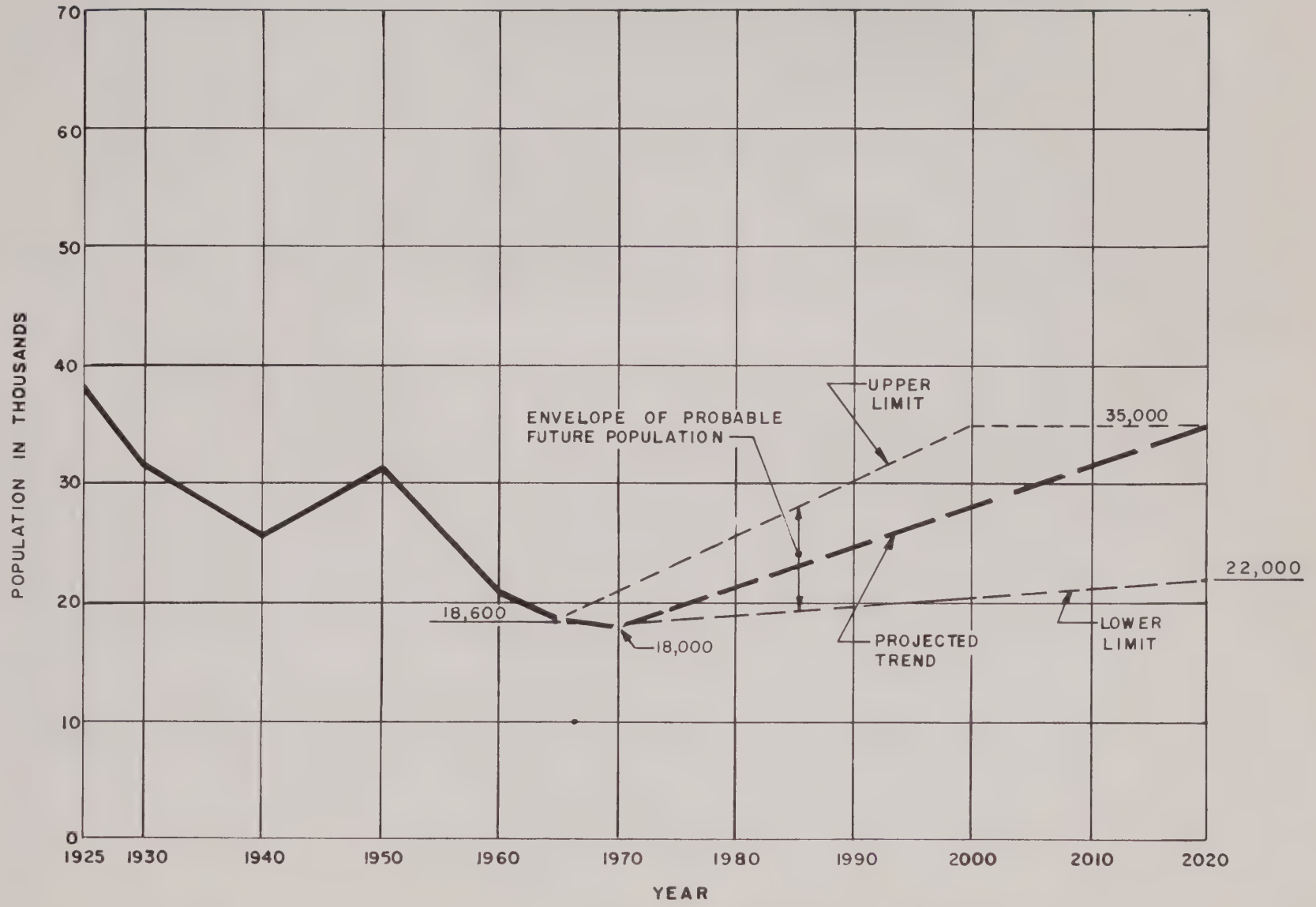


FIG. 7 POPULATION TRENDS FOR WARD 2

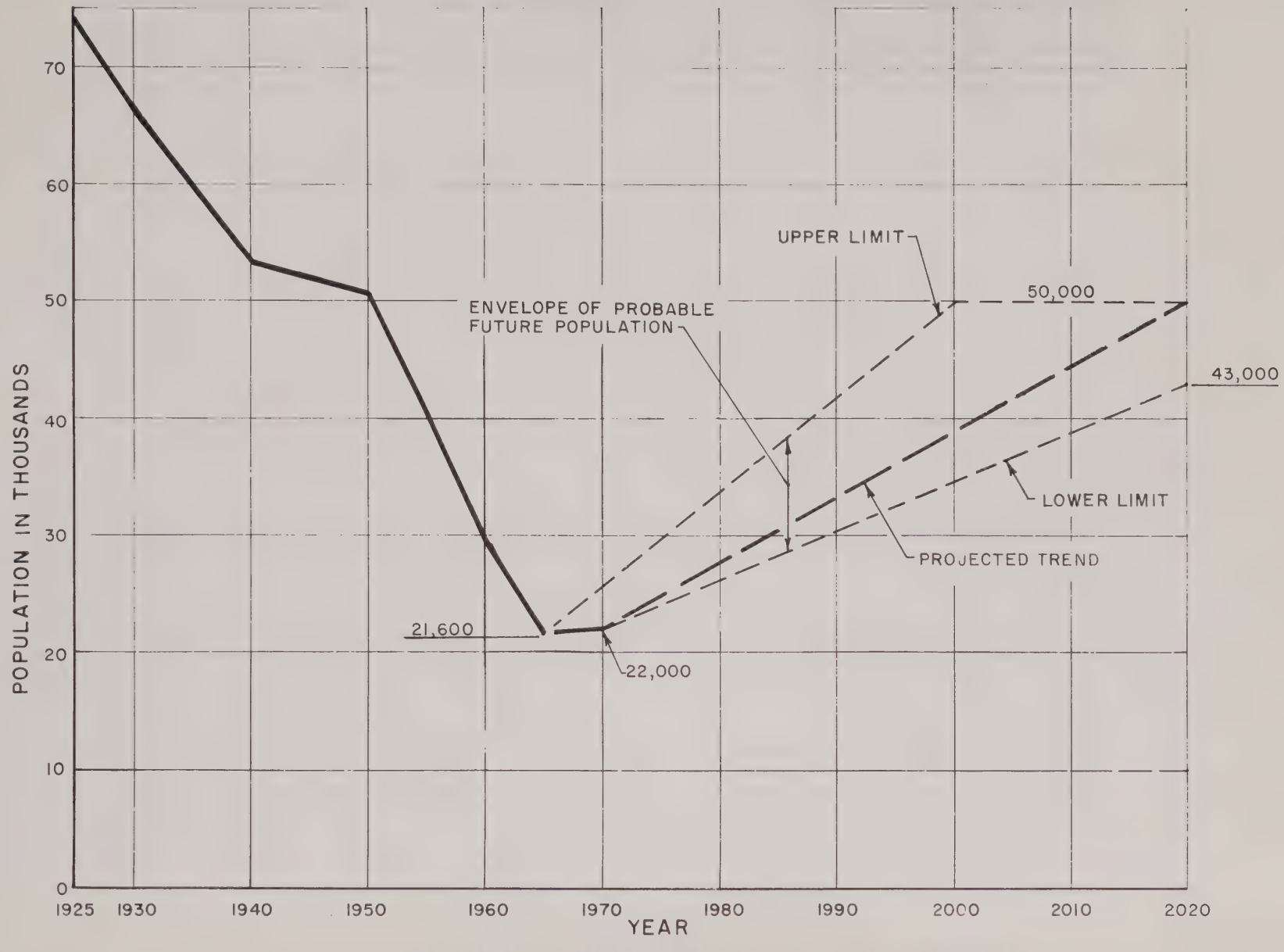


FIG. 7 POPULATION TRENDS FOR WARD 3

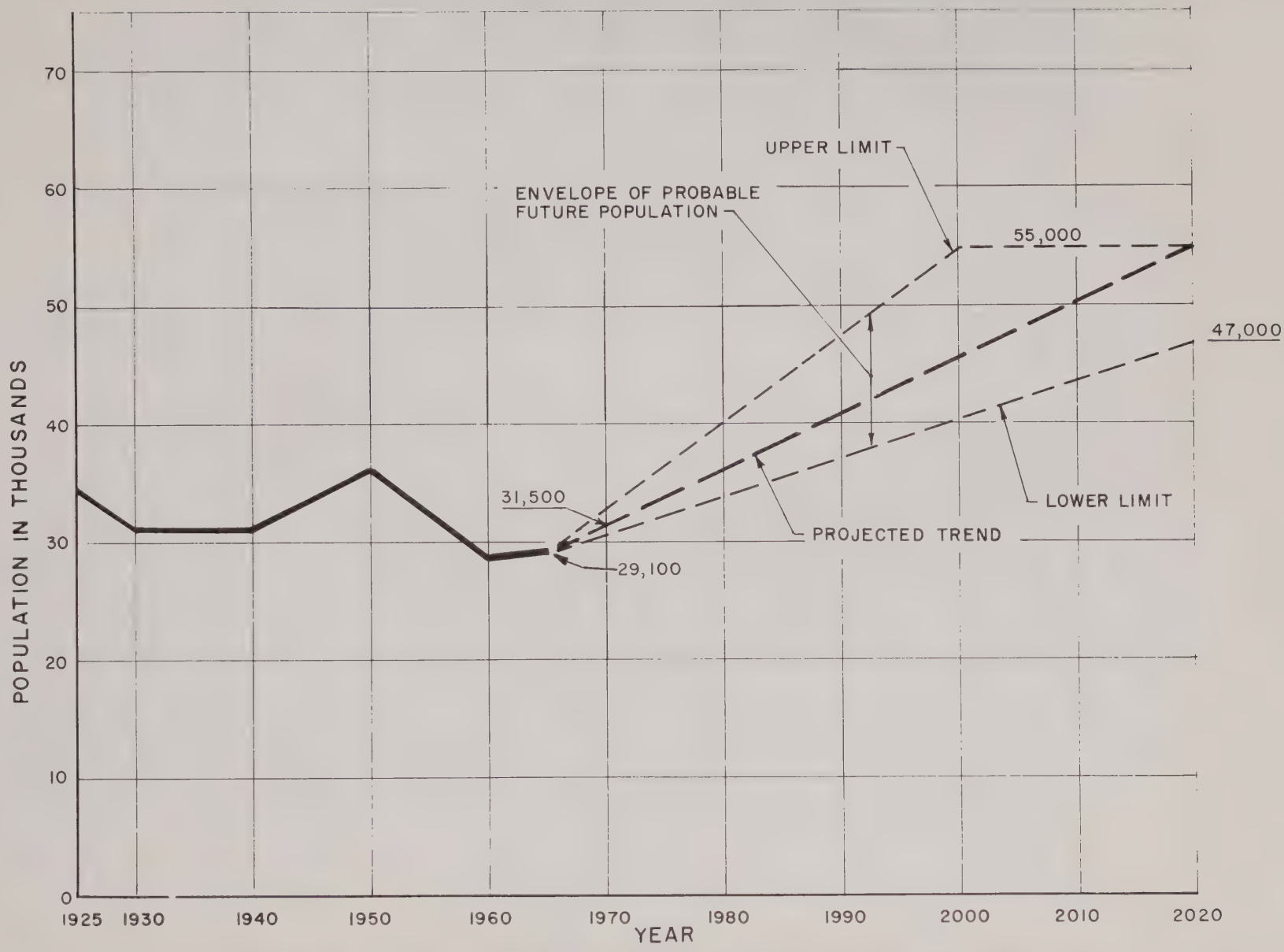


FIG. 7 POPULATION TRENDS FOR WARD 4

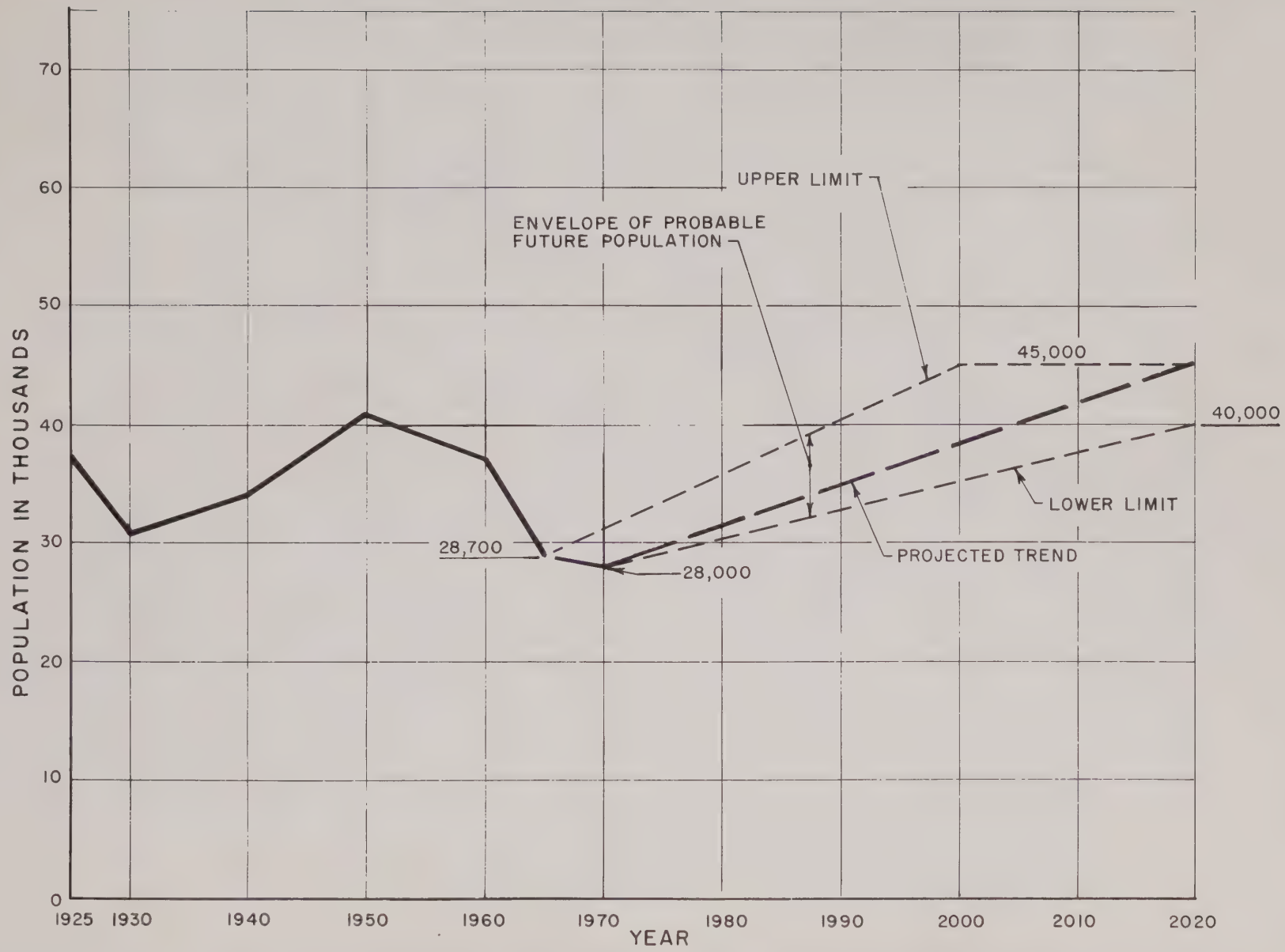


FIG. 7 POPULATION TRENDS FOR WARD 5

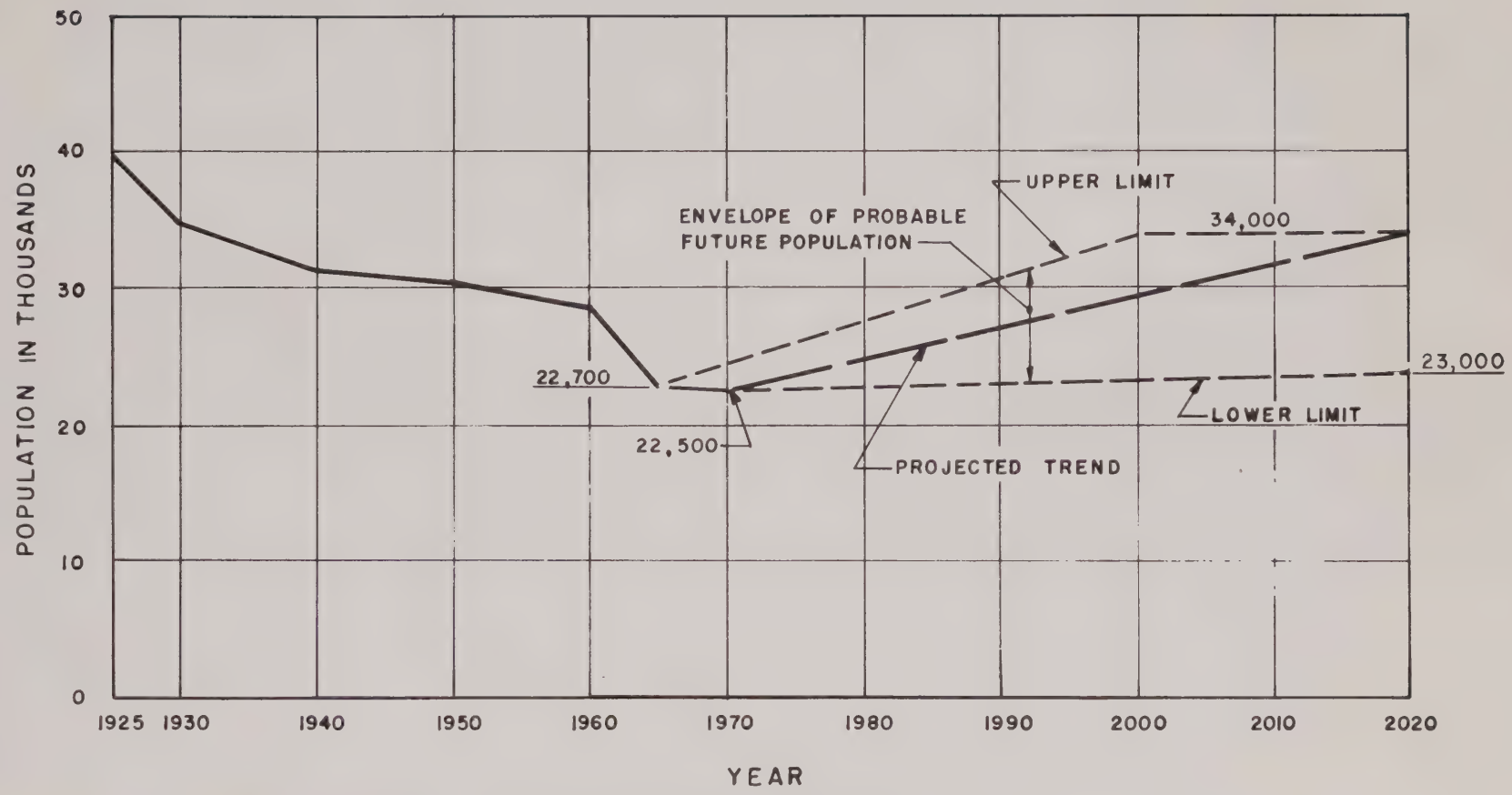


FIG. 7 POPULATION TRENDS FOR WARD 6

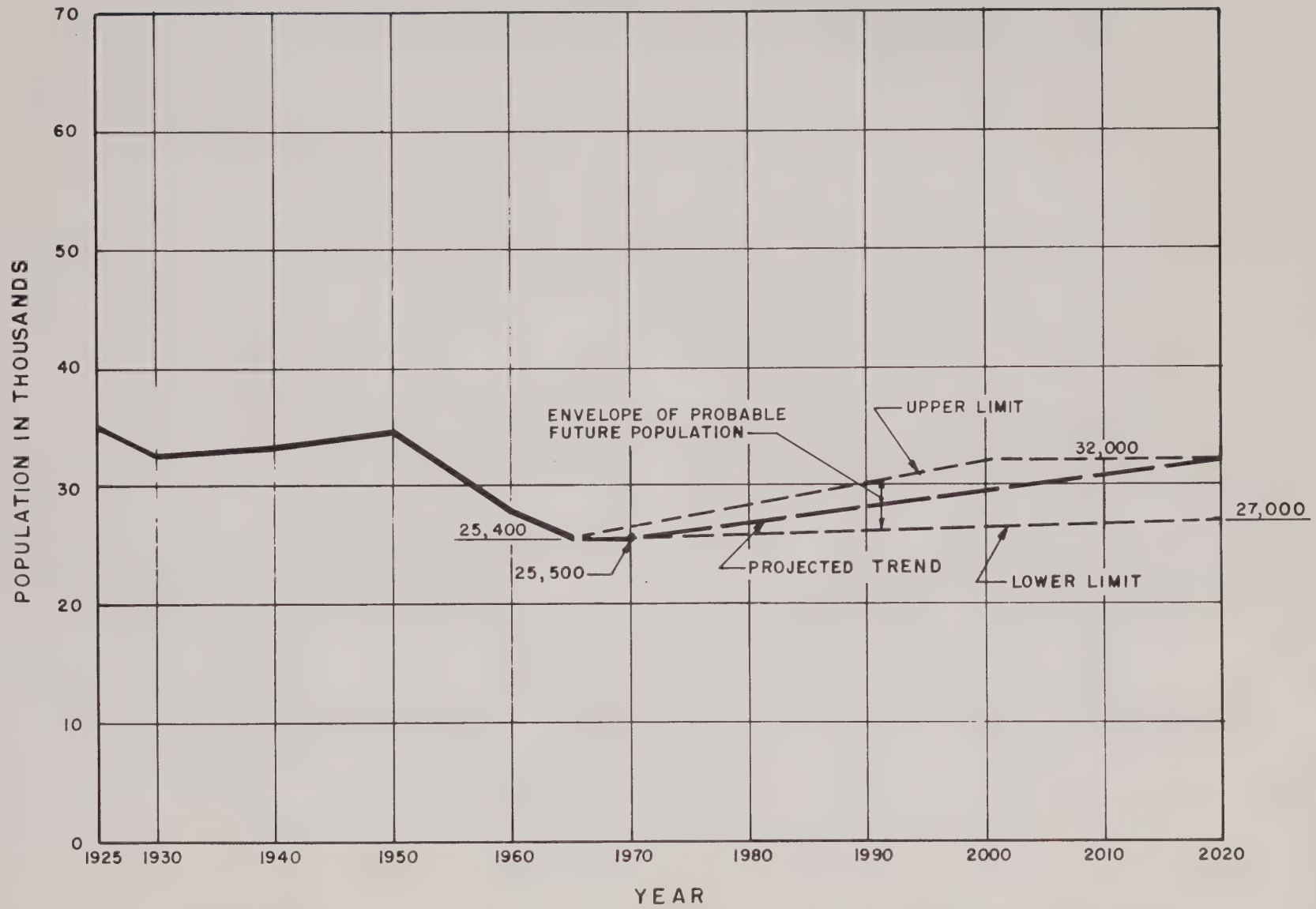


FIG. 7 POPULATION TRENDS FOR WARD 7

257-8359

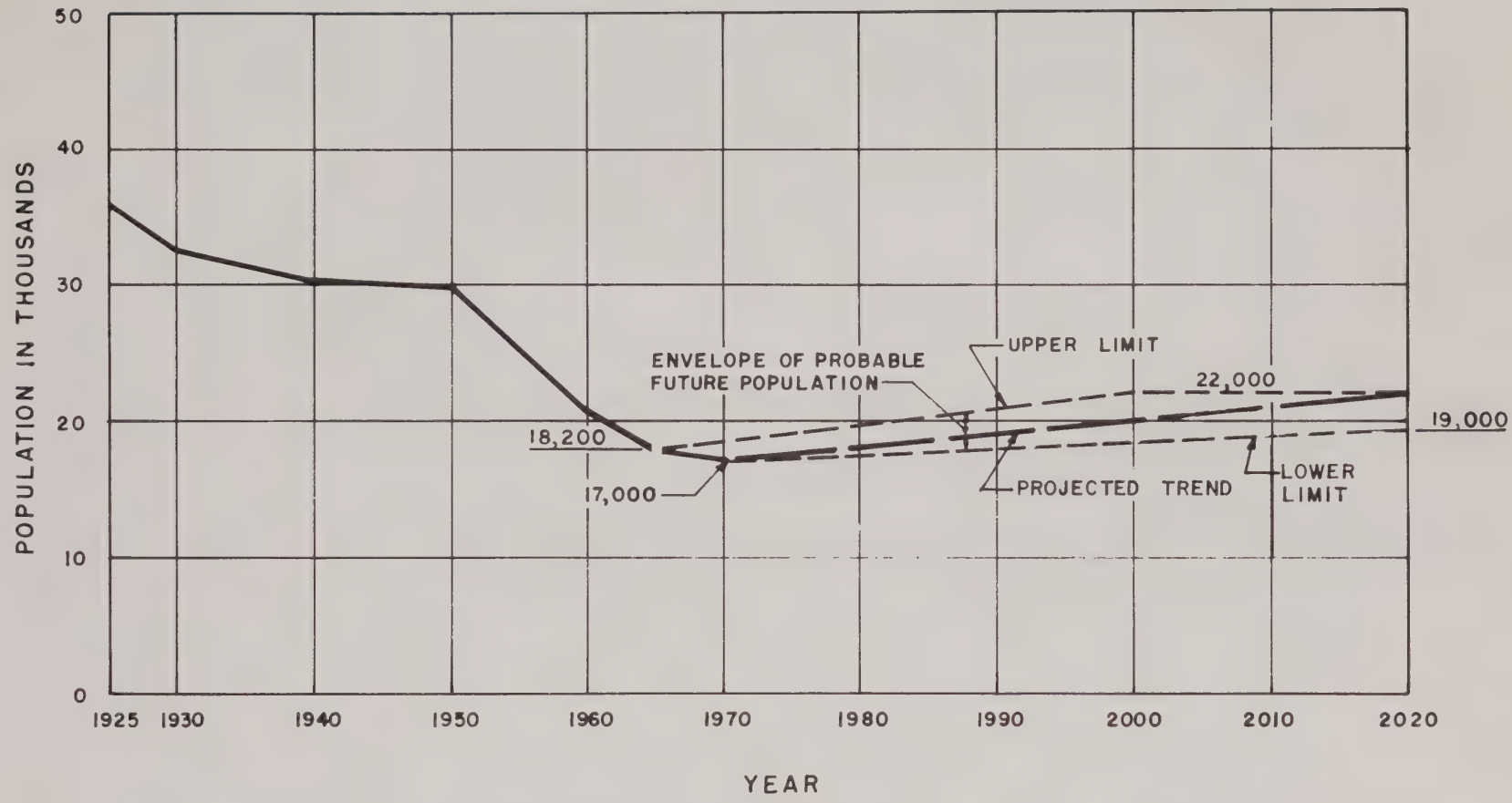


FIG. 7 POPULATION TRENDS FOR WARD 8

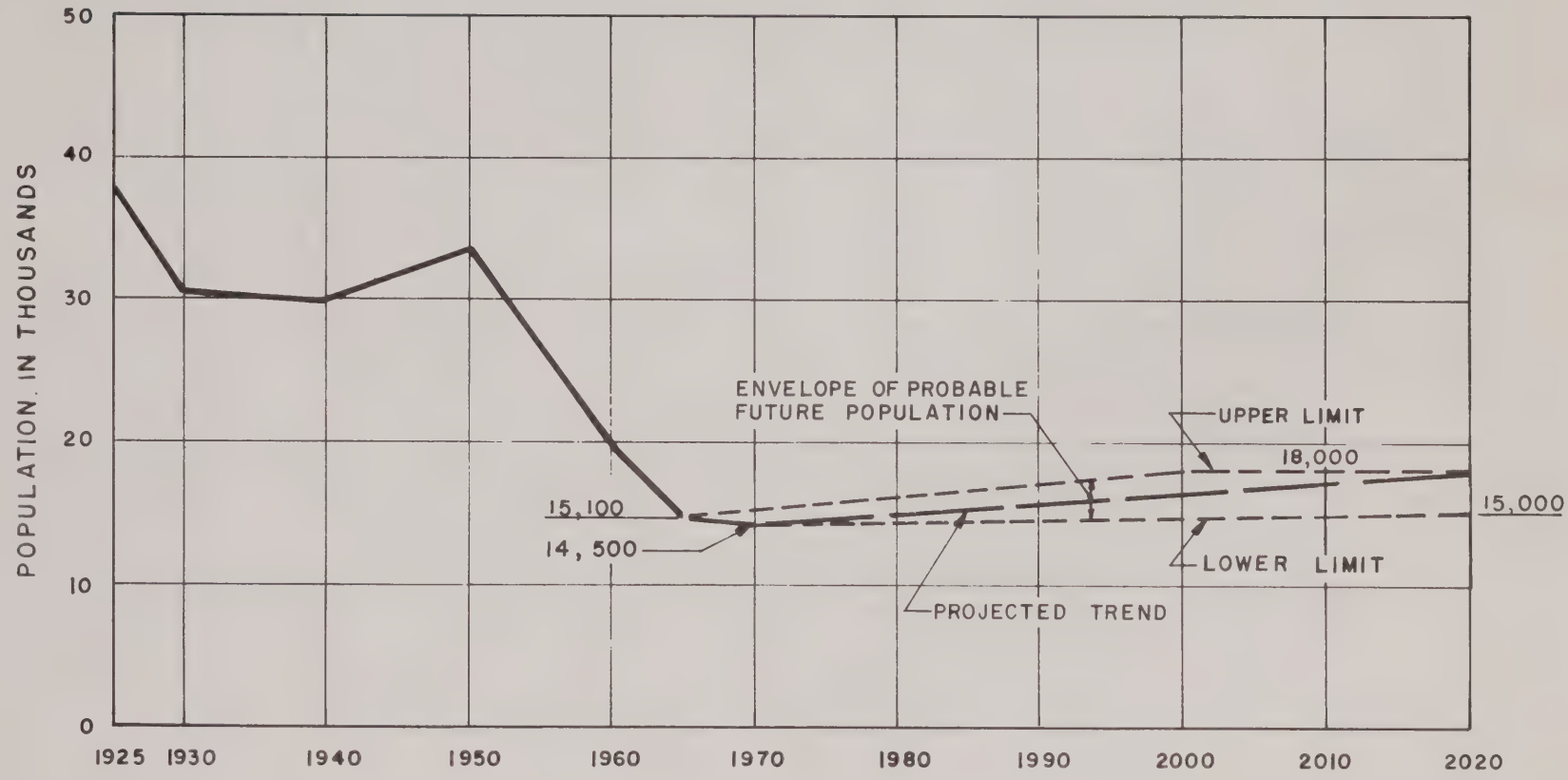


FIG. 7 POPULATION TRENDS FOR WARD 9

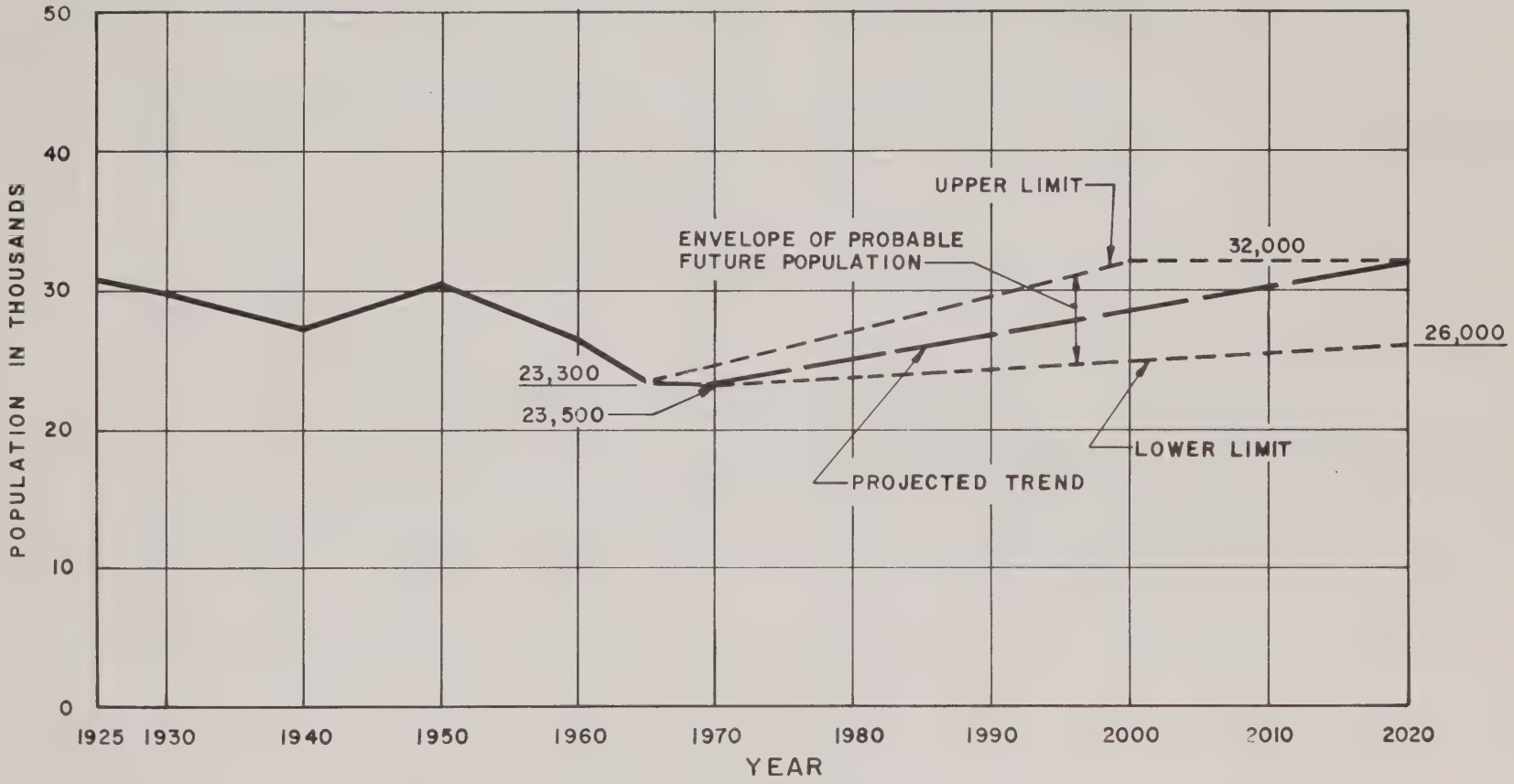


FIG. 7 POPULATION TRENDS FOR WARD 10

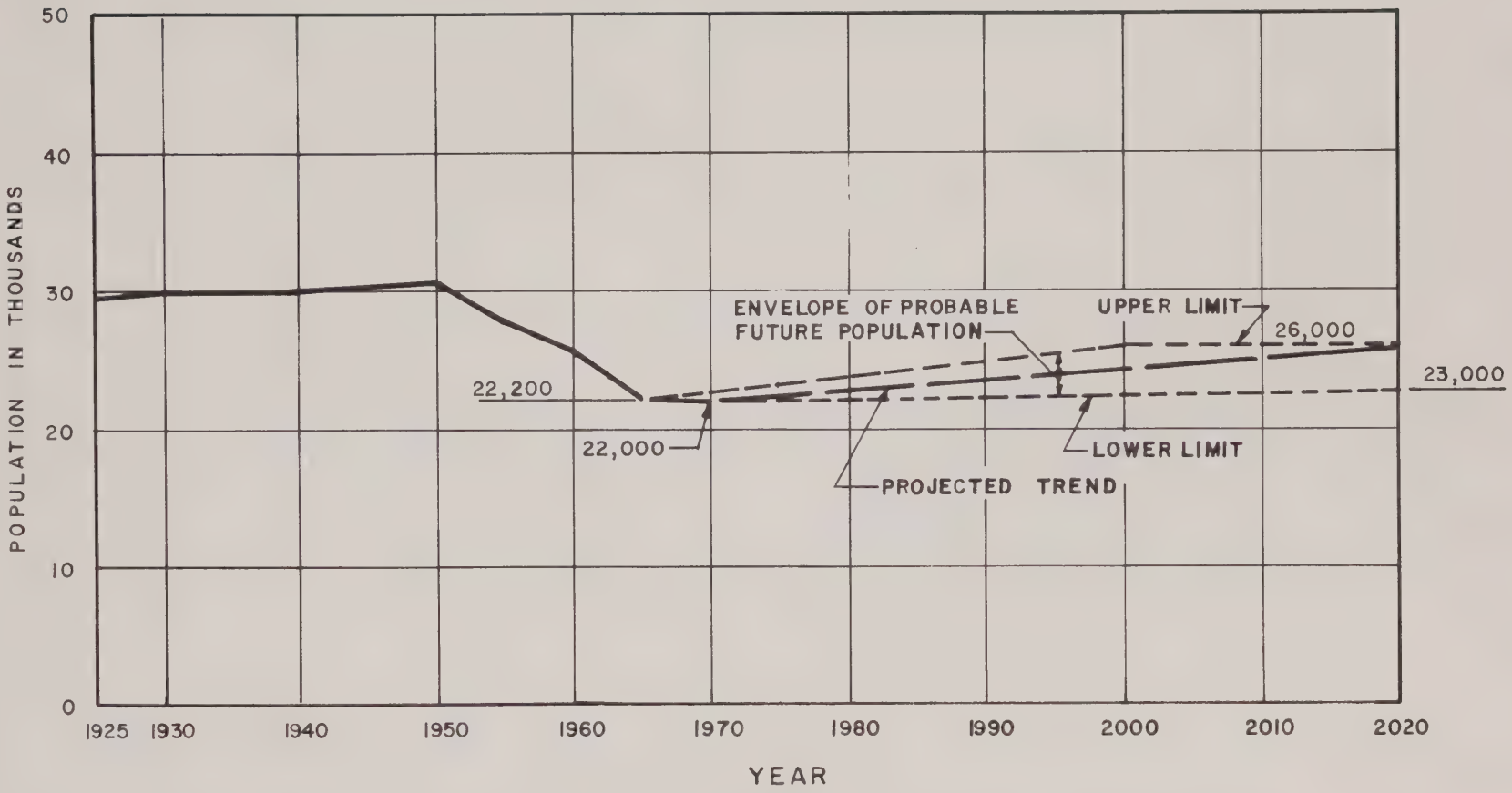


FIG. 7 POPULATION TRENDS FOR WARD II

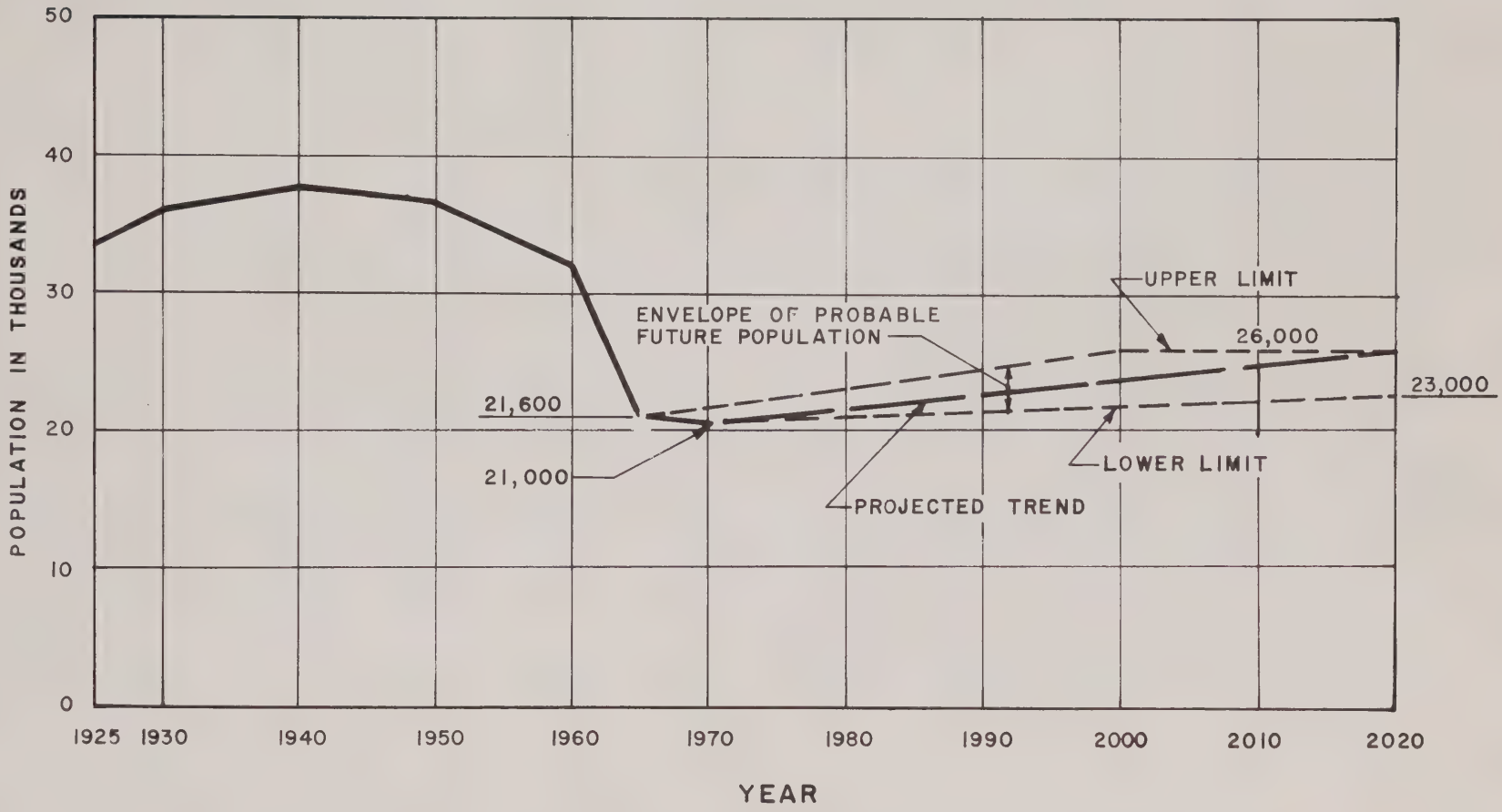


FIG. 7 POPULATION TRENDS FOR WARD 12

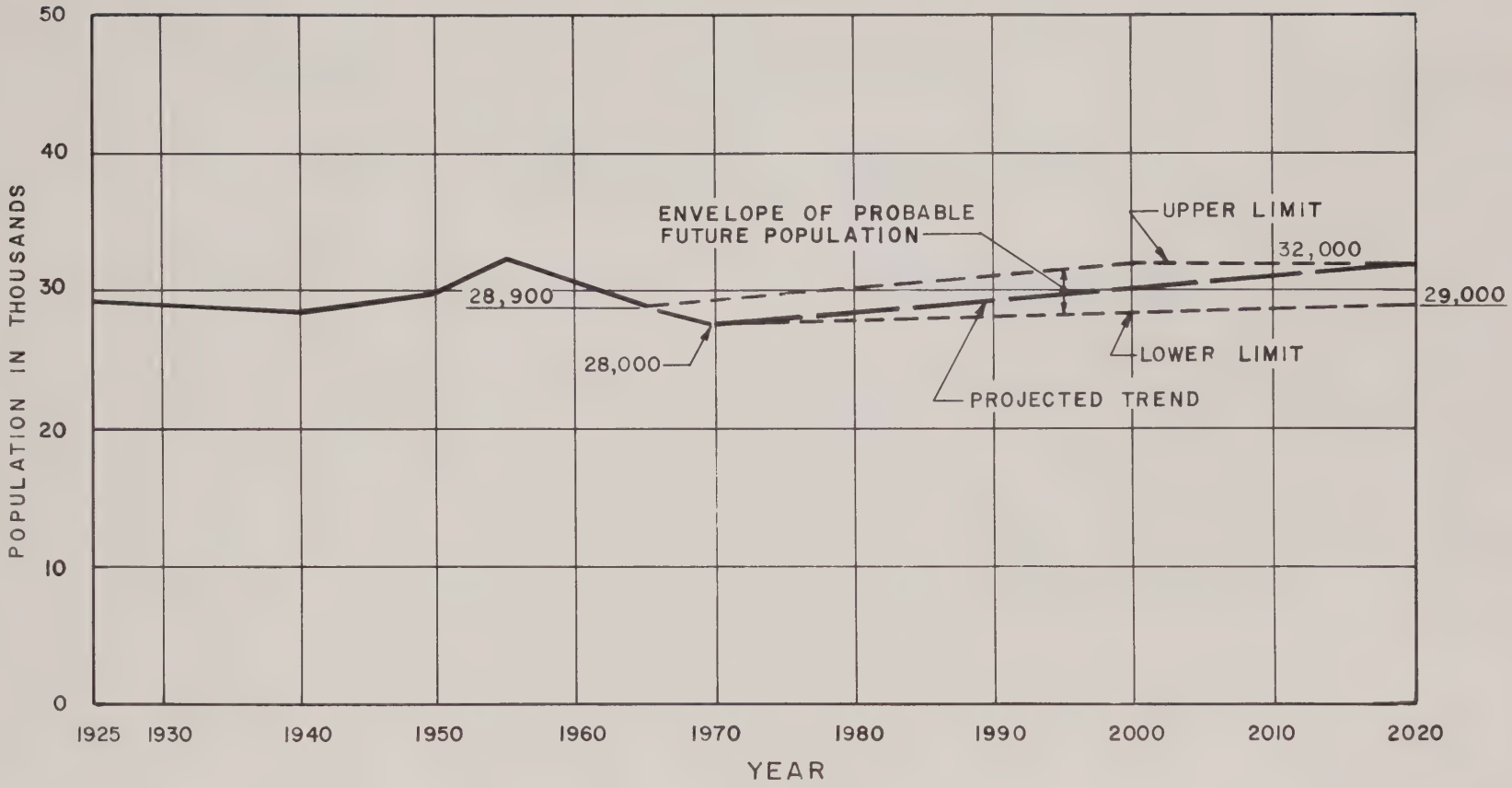


FIG. 7 POPULATION TRENDS FOR WARD 13

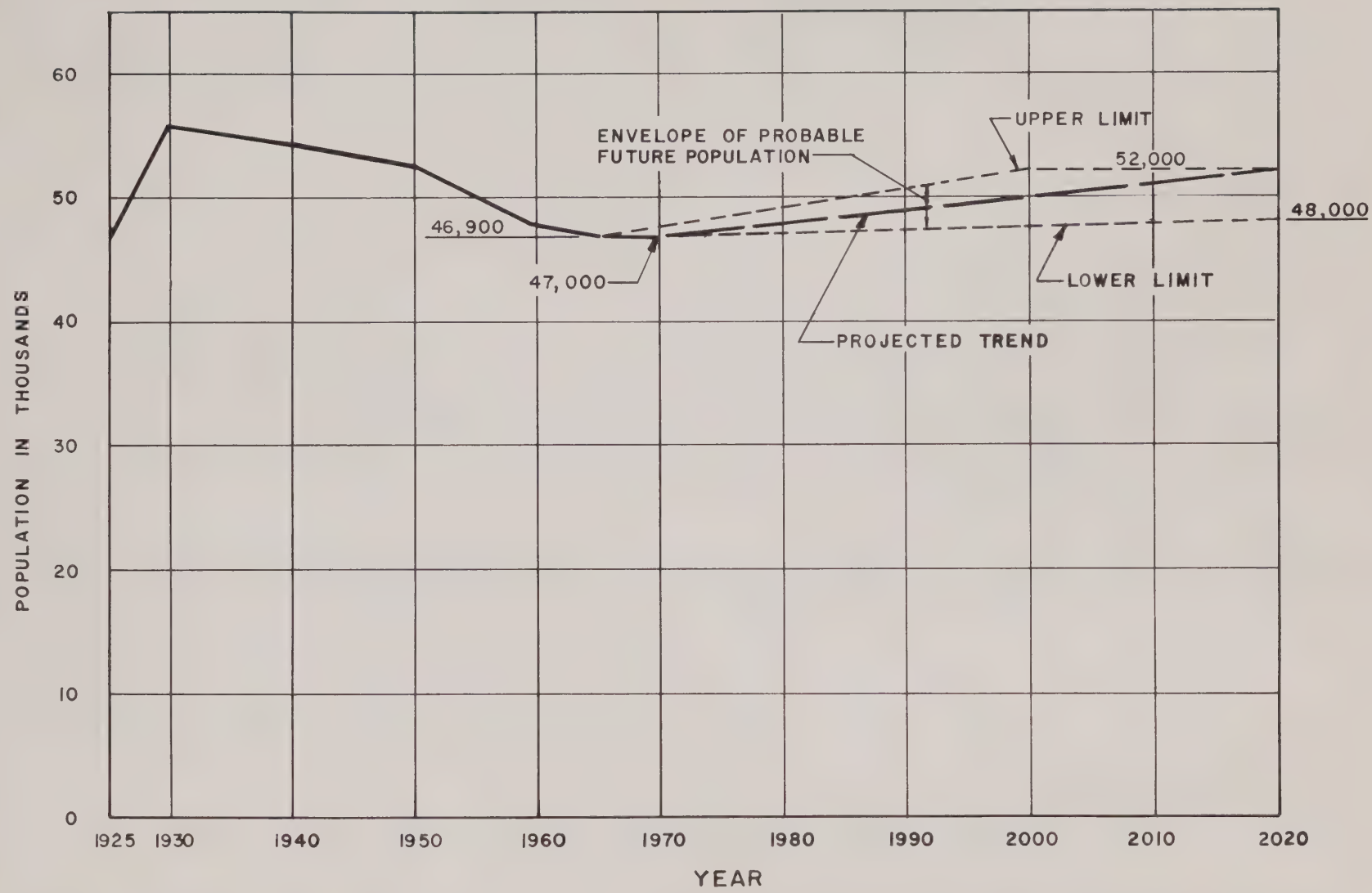
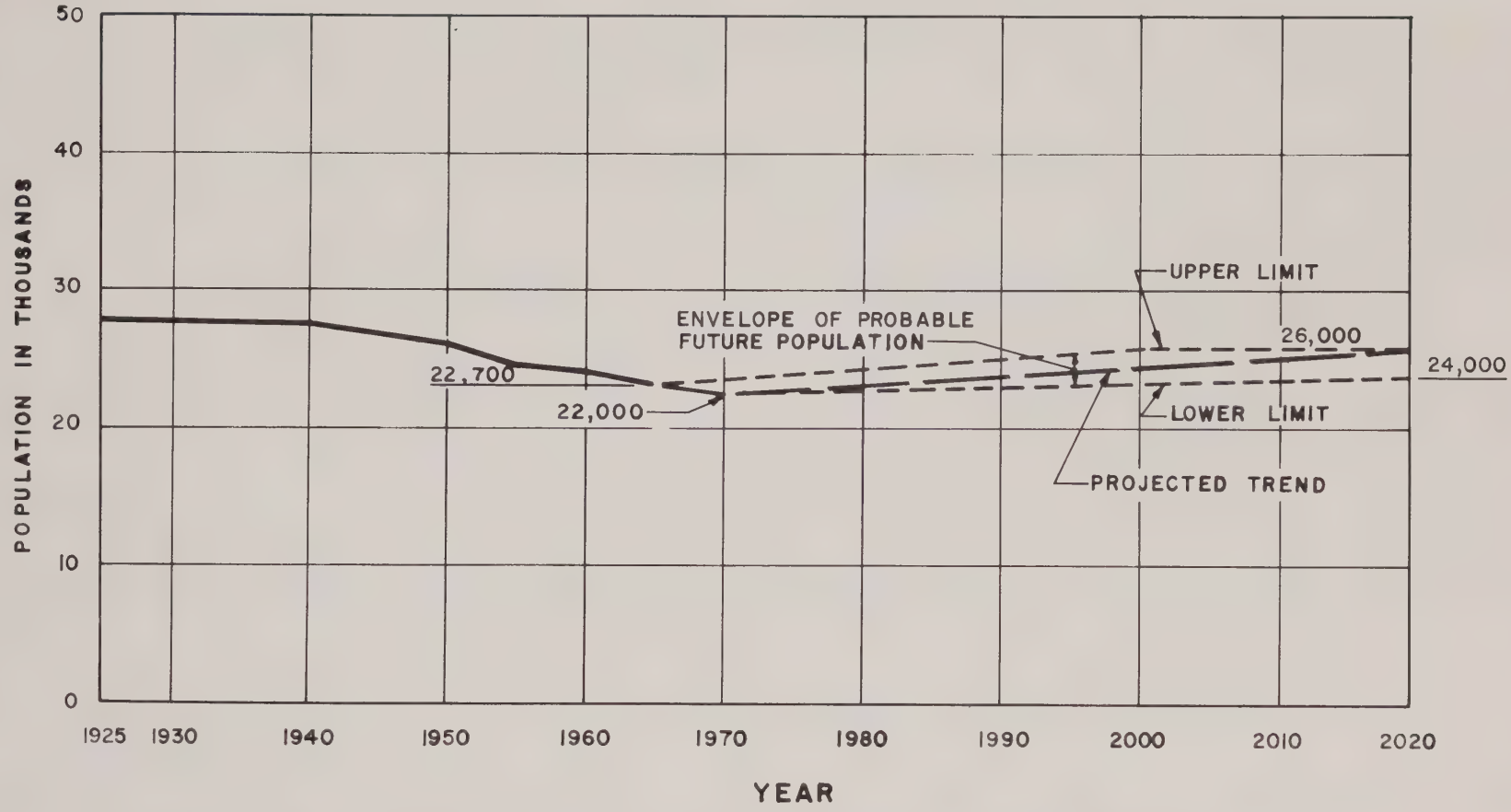


FIG. 7 POPULATION TRENDS FOR WARD 14



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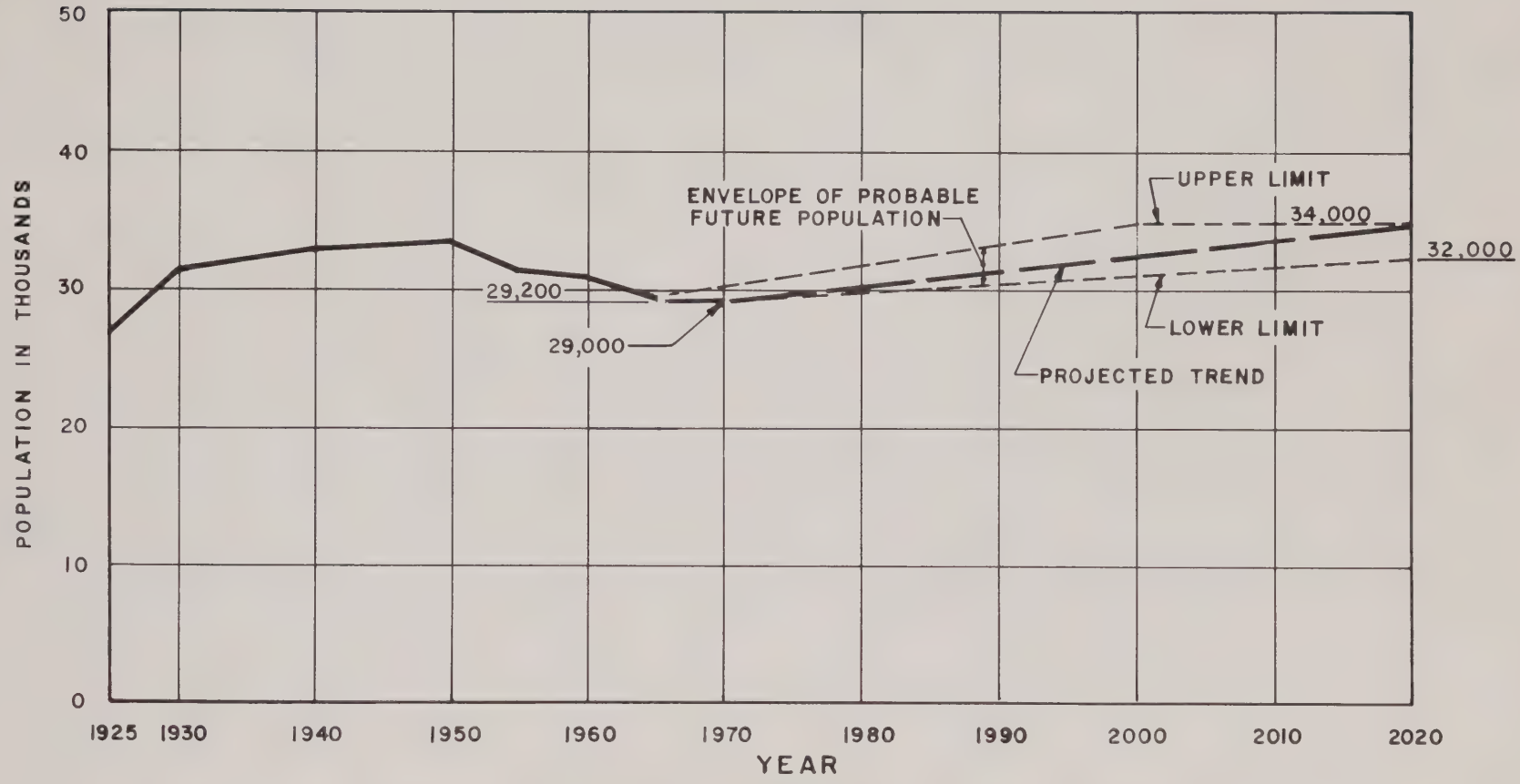

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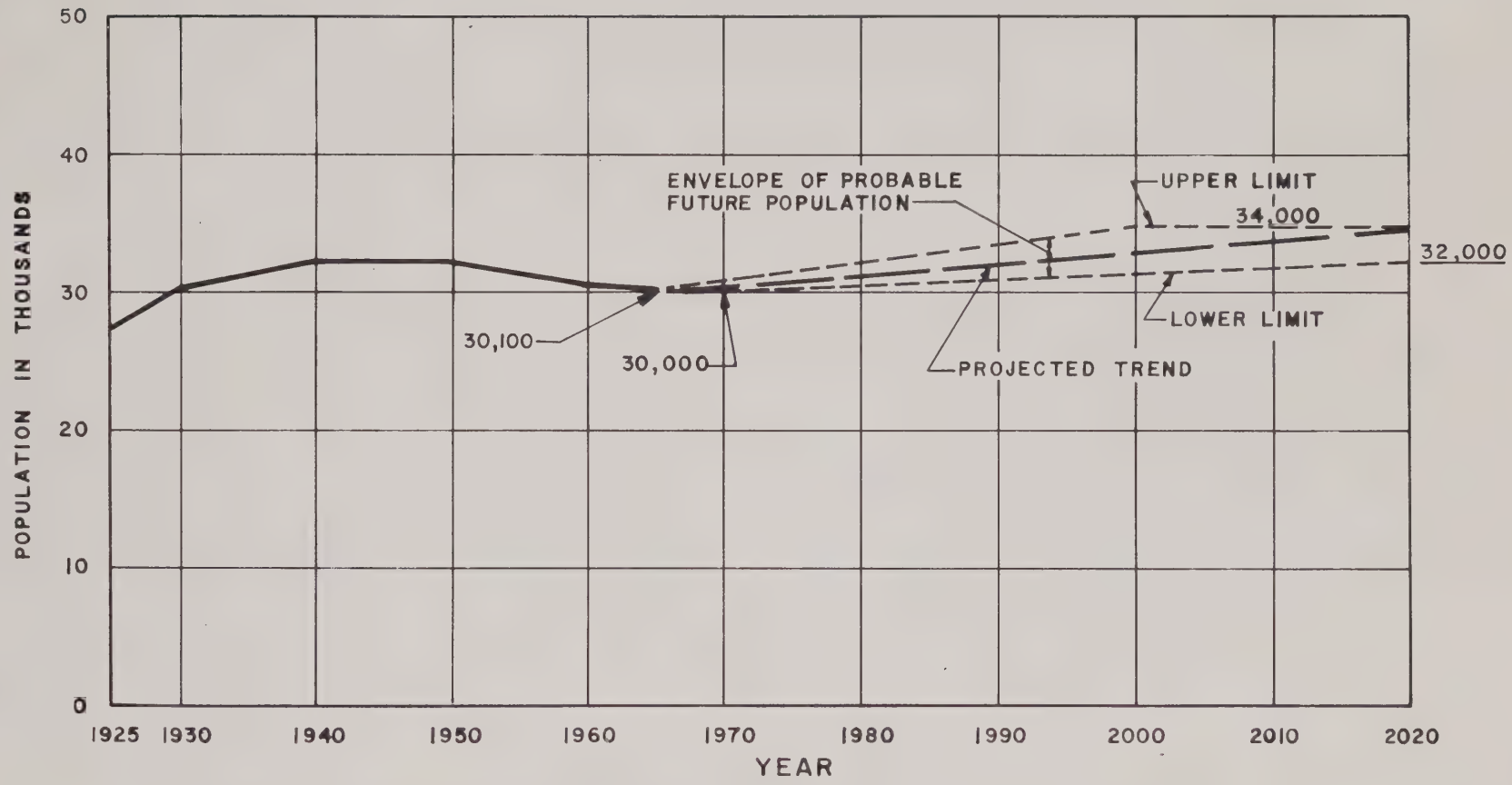

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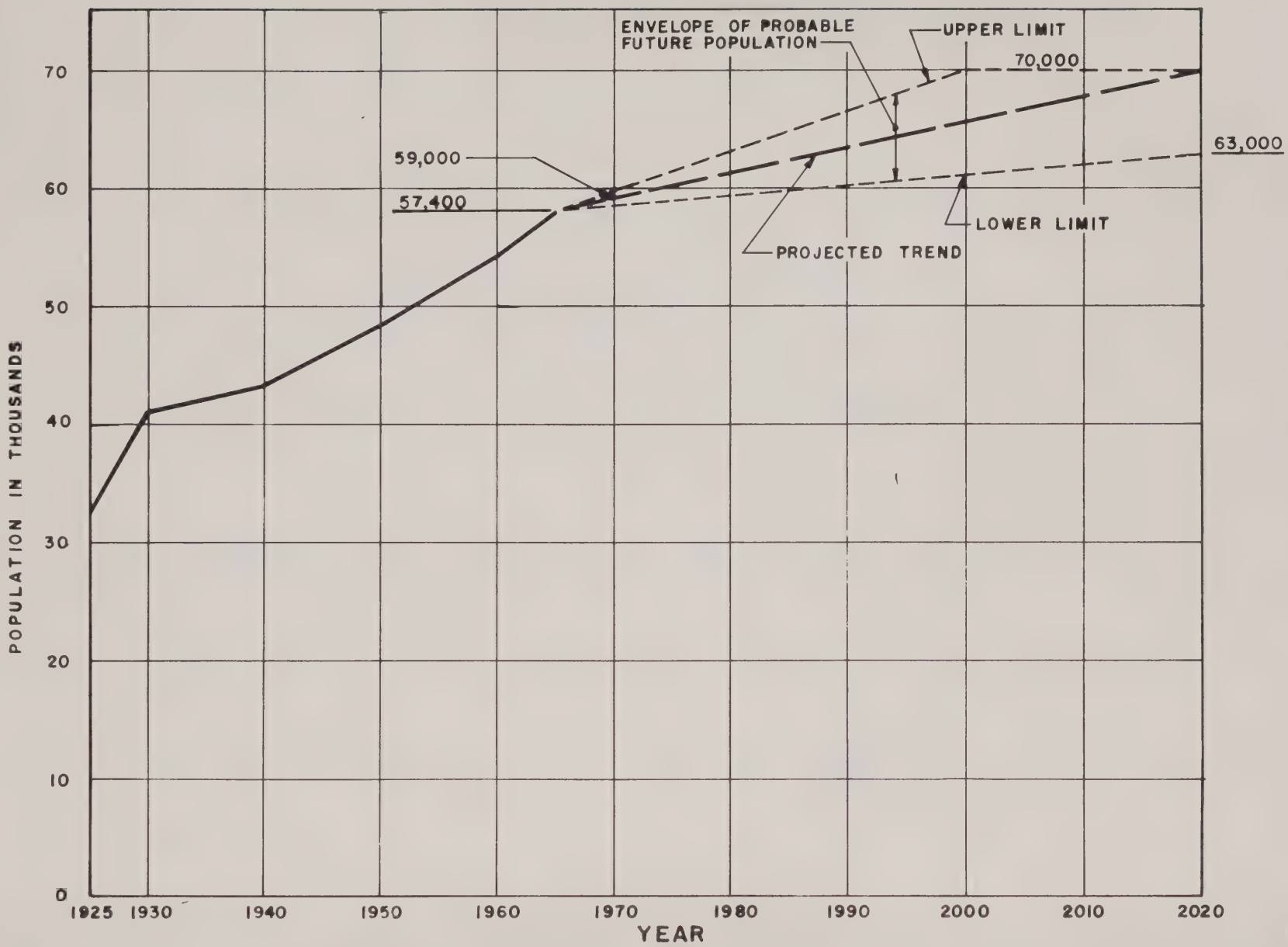

FIG. 7 POPULATION TRENDS FOR WARD 18

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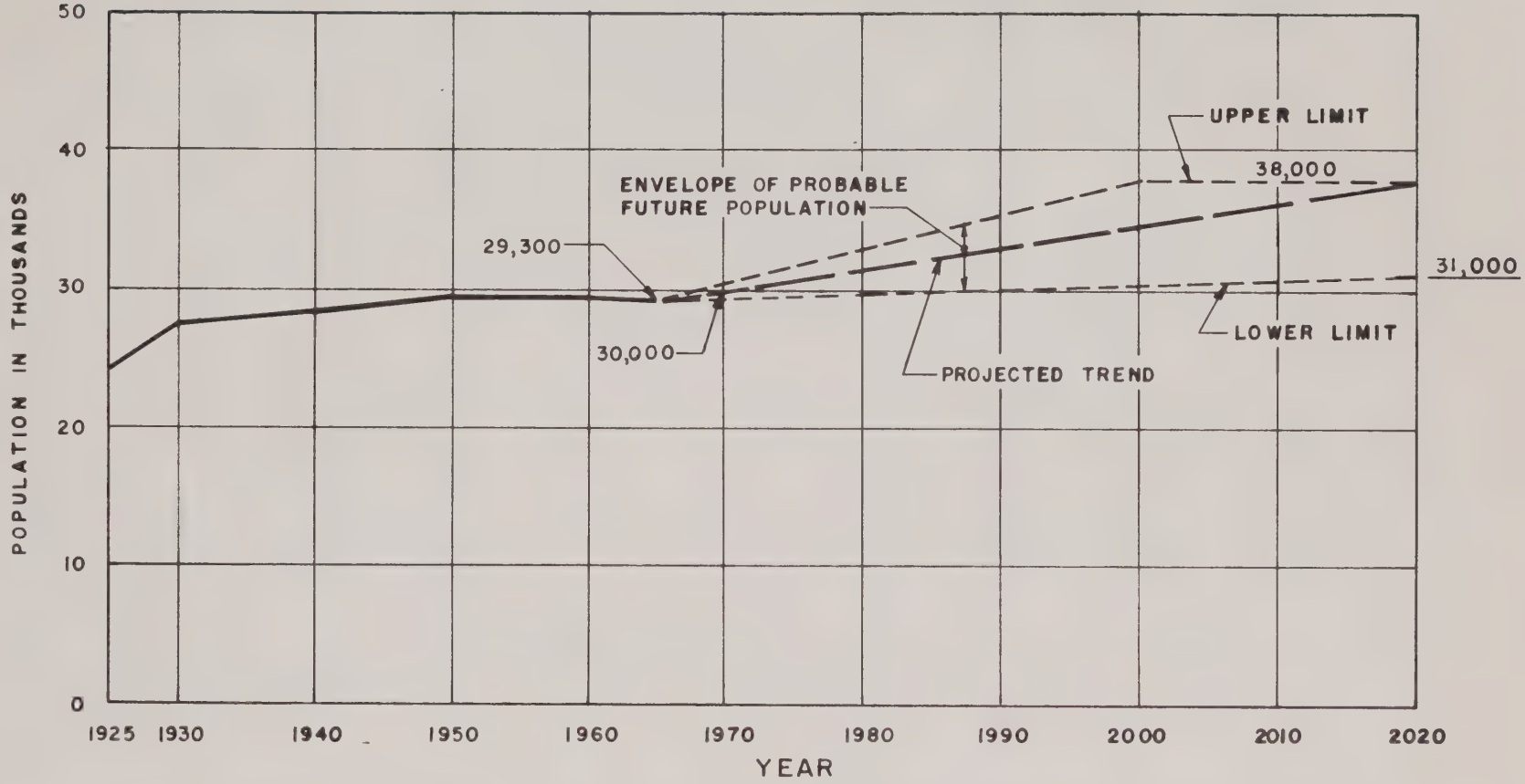

FIG. 7 POPULATION TRENDS FOR WARD 19

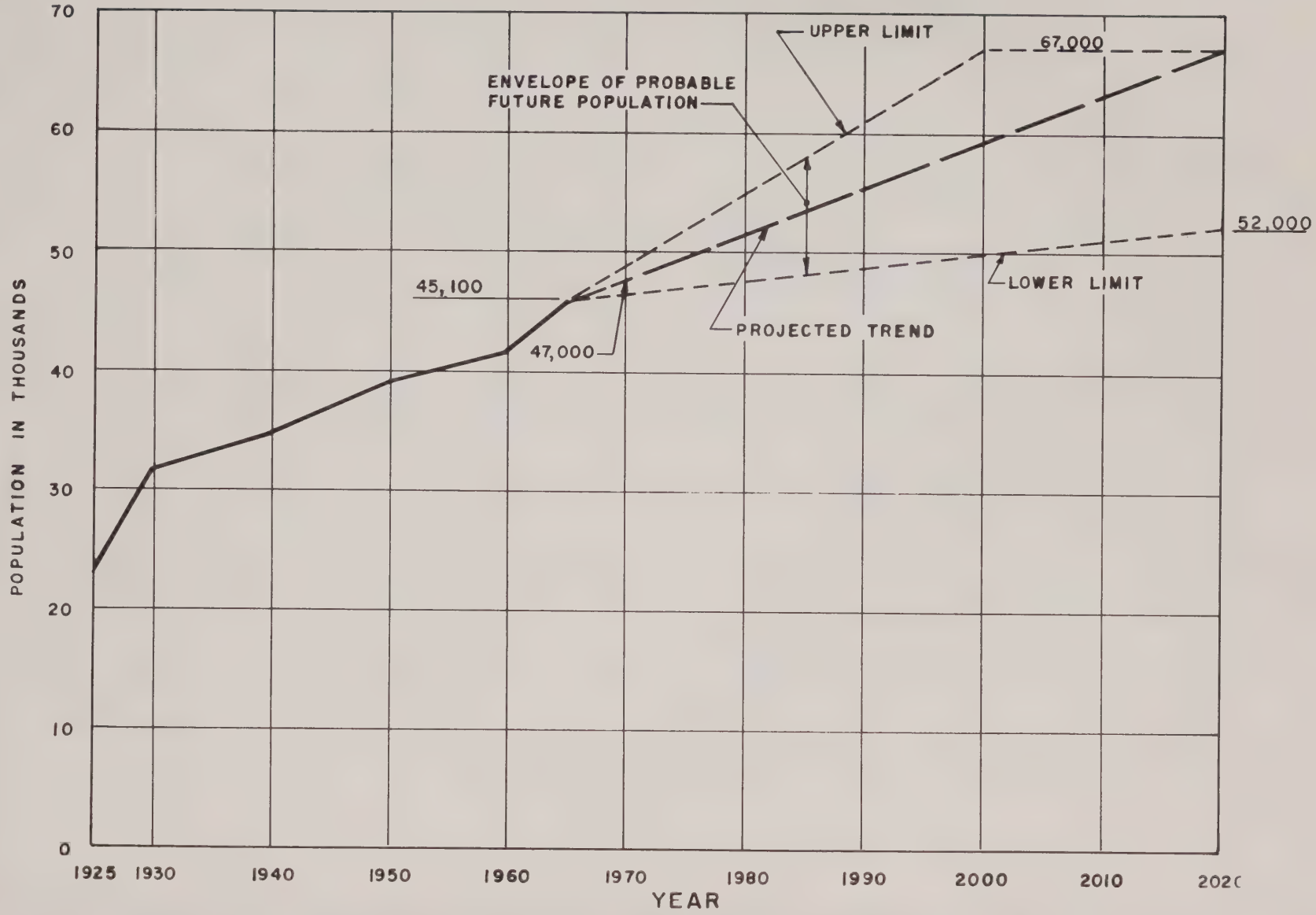

FIG. 7 POPULATION TRENDS FOR WARD 20

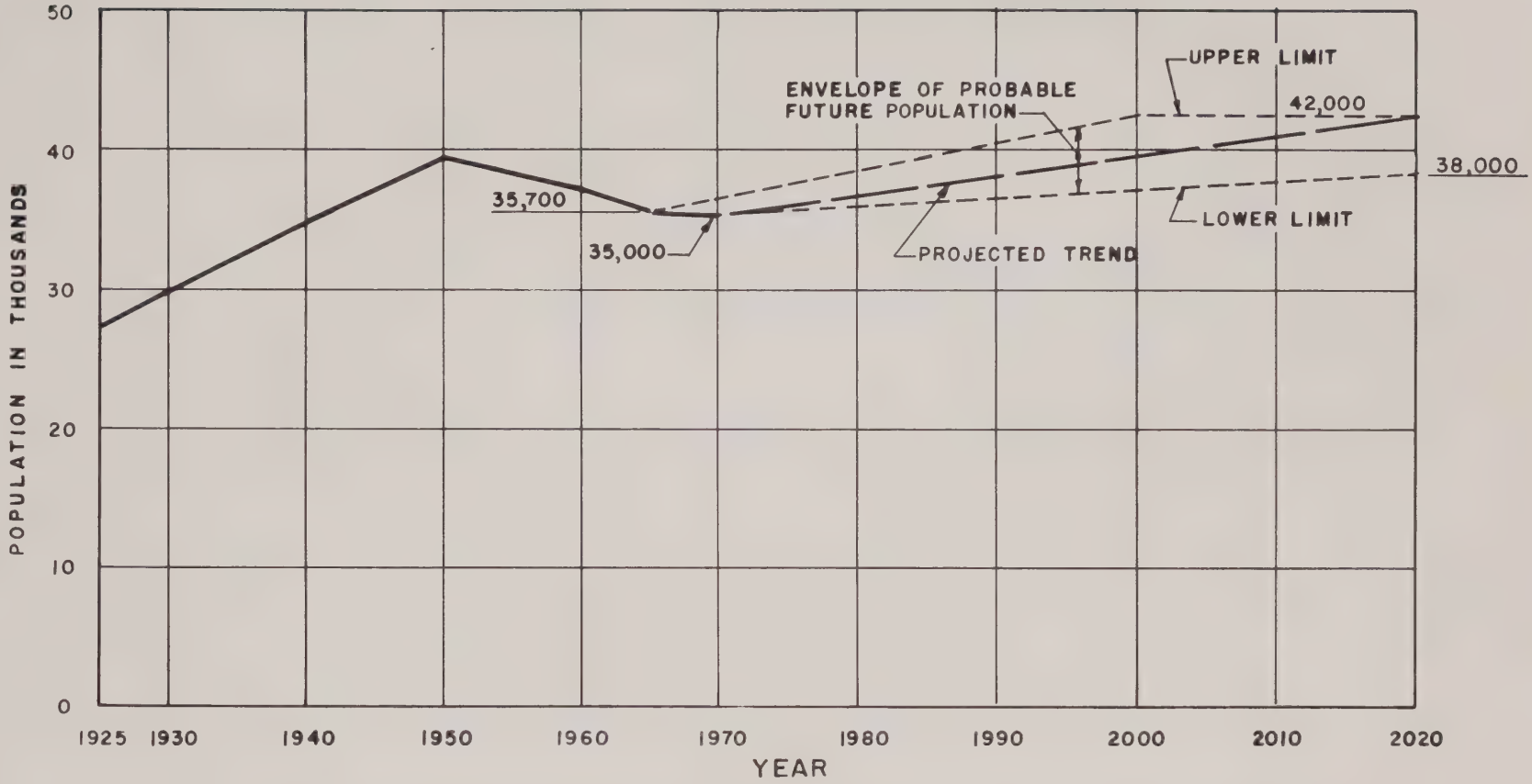

FIG. 7 POPULATION TRENDS FOR WARD 21

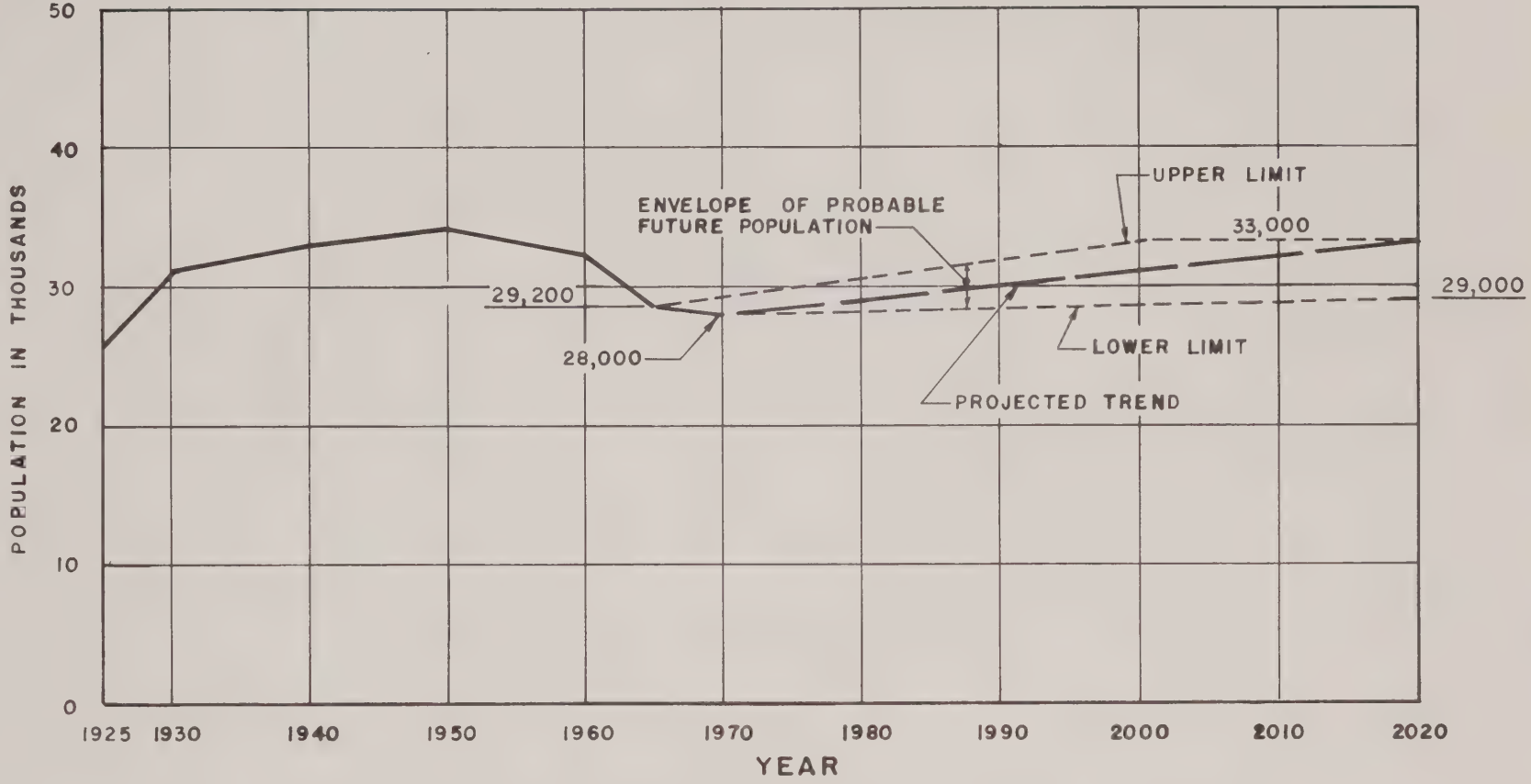

FIG. 7 POPULATION TRENDS FOR WARD 22

APPENDIX D

APPENDIX D

CONDITION AND CAPACITY OF EXISTING OUTLETS

Existing outlets from the Boston Sewerage System have been inspected in the field insofar as practicable, and the results are shown on Table 1 which follows.

A general description of the existing outlets and the function of their appurtenant facilities is presented in Chapter III. Outlets described in Table 1 are located approximately as shown on Figure 4 , Appendix B. Recommended improvements to existing combined sewer outlets are discussed in Chapters VIII and IX.

Storm drain outlets have in general not been inspected because they are not considered to contribute to pollution of waterways. However, certain storm drain outlets have been inspected, which were readily accessible or were believed to be carrying sewage in addition to storm water.

We have assigned outlet numbers to all outlets which discharge directly to open or enclosed bodies of water, such as Boston Harbor, Mystic River, Charles River, the Fens, the Roxbury Canal and Dorchester Brook Conduits, Dorchester Bay and Neponset River.

In addition, we have assigned outlet numbers to outlets from the MDC Fens Gate House and from the West Side Interceptor to the MDC Boston Marginal Conduit. While outlet numbers are shown for outlets from the Boston Marginal Conduit to the Charles River Basin, such outlets have not been inspected, inasmuch as they do not directly receive overflows from the Boston system.

Outlet numbers indicated are the same as those presented in Massachusetts House Document No. 1600, dated January 1937 with the following exceptions;

1. Outlets not described in House 1600, or which have been extended combined with other outlets since 1937, and those which we consider as exterior outlets have been assigned numbers above 200.

2. Outlets tributary to the Boston Marginal Conduit, which were described as "interior overflows" in House 1600, have been assigned the same numbers as in that document preceded by the prefix "X".

3. Outlet numbers below 109 which are not shown, were not listed in House 1600.

Outlets are described from regulating structures, if any, to points of discharge. Regulators have been described, in general, as sump, sluice gate, high outlet or weir types depending on the observed arrangement.

The term tide gates used herein includes devices for the control of back water where tidal variations do not exist immediately downstream from the gates.

Estimated outlet capacities in Table 1 have been computed with consideration given to the conditions which control capacities. The controlling conditions have generally been the capacities of conduits entering or leaving regulating structures flowing full at invert slope and without surcharge. Where invert slopes of controlling conduits are flat or are not known, we have determined the flowing-full capacity based on a minimum velocity of 3.0 fps. In some cases, surcharge would be required to produce a velocity of 3.0 fps.

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
East Boston				
III	Belle Isle Inlet	Regulator and tidegate chamber followed by 96-in x 44-in arch and scow-bottom-shaped, brick and wood conduit on MDC North Met. Trunk Sewer.	Inaccessible	--
1	Orient Heights Beach, near Trident Street extended	60-in x 72-in brick conduit extended as 66-in circ. reinf. conc. conduit.	Storm drain surcharged at high tide. No. pollution evident.	--
2	Orient Heights Beach, at Rice Street extended	Abandoned 10-in x 10-in rect. wood drain.	--	--
3	Tidal flats NW of airport, Moore Street extended	Sump-type regulator and tidegate chamber, followed by 60-in circ. reinf. conc. conduit. Single 60-in x 60-in rect. wooden tide gate. Stop-log, sheargate, and float chambers on dry weather connection.	Dry weather connection working satisfactorily. Moderate sludge build-up at sump. Light sludge build-up at tidegate chamber. Tide gate leaks at high tide.	17.3
4	Tidal flats NW of airport, Prescott Street extended	Outlet abandoned. (Sewage going to MDC sewer in Bremen Street and stormwater discharging to outlet No. 5 at Porter Street)	--	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
East Boston				
5	Boston Harbor, Southwest side of airport at Sumner Street extended, from Porter Street at Bremen Street	Sump-type regulator connected by 2-60-in circ. brick conduits in parallel, to tidegate chamber at Bremen Street, followed by 72-in x 76-in brick conduit, extended as 54-in x 90-in horseshoe-shaped, reinf. conc. conduit to Orleans Street, 69-in x 90-in horseshoe-shaped reinf. conc. conduit to Cottage Street and a 144-in x 120-in horseshoe-shaped, reinf. conc. conduit across the airport to Boston Harbor. Two pairs of 60-in double-leaf, wooden tide gates in series. Second tidegate chamber near end of outlet, with two pairs of 84-in x 120-in rect. wooden tide gates in series.	Dry weather connection working satisfactorily. Light sludge build-up in upstream tidegate chamber. One remaining tide gate stuck open. Downstream tidegate chamber inaccessible, but not leaking significantly.	316.0
		Sump-type regulator at Gove Street followed by 48-in x 51-in modified circle brick conduit extending in Orleans Street to tidegate chamber at Porter Street outlet. Two 48-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection blocked and all flow going to outlet. Heavy sludge build-up in sump and medium in tidegate chamber. Tide gates stuck open	
		Sump-type regulator and tidegate chamber at Maverick Street followed by 60-in x 60-in horseshoe-shaped, reinf. conc. conduit extending in Cottage Street to Porter Street outlet. Two 36-in double-leaf, wooden tide gates in series. Stop-log, and sheargate chambers on dry weather connection.	Dry weather connections blocked and all flow going to outlet. Heavy sludge build-up in tidegate chamber Tidegates stuck open.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
East Boston				
6	Boston Harbor at Maverick Street extended	Sump-type regulator at Jeffries Street connected by 51-in circ. reinf. conc. conduit to tidegate chamber followed by 42-in circ. reinf. conc. conduit to second tidegate chamber serving 60-in circ. reinf. conc. airport drain. Two 48-in x 48-in rect. wooden tide gates in series at upstream chamber. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working satisfactorily. Heavy sludge build-up. 48-in tide gates not accessible. All manholes surcharged at high tide.	22.0
7	Boston Harbor at Sumner Street extended	Sump-type regulator at Jefferies Street followed by 24-in x 27-in ovoid-shaped brick conduit. No tidegate chamber found. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working but partially blocked. Moderate sludge build-up. Above tidal influence.	25.7
8	Not operating	--	--	--
9	Boston Harbor at Ruth Street	Sump-type regulator and tidegate chamber at Marginal Street, followed by 24-in x 26-in rect. wooden section. Two 36-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working but partially blocked. Moderate sludge build-up in sump and tidegate chamber. Tide gates stuck partially closed. Slight back-flow at high tide.	9.8

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
East Boston				
10	Boston Harbor at Cottage Street extended	Sump-type regulator and tidegate chamber at Marginal Street, followed by 30-in x 36-in rect. wooden conduit Two 36-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working satisfactorily. Tidegate chamber filled with debris. Upstream gate partially open. Downstream gate stuck closed and tight.	16.9
11	Boston Harbor near Lewis Street extended	24-in storm drain.	Dry	--
12	Boston Harbor at New Street extended	High outlet-type regulator and tidegate chamber at Sumner Street followed by 36-in x 36-in rect. wooden tide gate followed by 36-in metal tide gate. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working satisfactorily. Light sludge build-up. Wooden tide gate stuck open. Metal tide gate not tight. Substantial backflow at high tide.	15.7
13	Boston Harbor near Decatur Street extended	High outlet-type regulator and tidegate chamber at Border Street, followed by 60-in circ. reinf. conc. conduit. 36-in metal tide gate. Stop-log and sheargate chambers on dry weather connection .	Dry weather connection working satisfactorily Little sludge build-up in regulator. Tidegate chamber filled with debris. Metal tide gate not tight. Substantial backflow at high tide.	25.4

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
East Boston				
14	Boston Harbor at Lexington Street extended	Weir-type regulator and tidegate chamber near Border Street followed by 36-in circ. wood conduit. Two 36-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection blocked and almost all flow going to outlet. All manholes surcharged. Upstream tide gates inaccessible. Downstream gate stuck open.	57.0
15	Boston Harbor at Lexington Street extended	15-in x 22-in concrete storm drain.	Not found	--
16	Boston Harbor at Eutaw Street extended	Sump-type regulator and tidegate chamber near Border Street, followed by 36-in x 36-in arch and scow-bottom-shaped, brick conduit extended as 20-in x 24-in rect. wooden conduit. Two 36-in double-leaf wooden tide gates. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection blocked and all flow going to outlet. Heavy sludge build-up. Tide gates stuck open. Sump surcharged at high tide.	99.7
17	Chelsea River at Meridian Street extended	Weir-type regulator at Condor Street, followed by 20-in x 24-in ovoid-shaped, brick conduit, extended as a 24-in circ. vit. clay conduit. No tidegate chamber found. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection blocked and all flow going to outlet. Heavy sludge build-up in regulator. Above tidal influence.	15.6
18	Chelsea River at Putnam Street	Abandoned 30-in x 36-in wooden conduit.	--	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
East Boston				
19	Chelsea River near Eagle Square	Sump-type regulator and tidegate chamber at E. Eagle Street followed by 48-in x 60-in egg-shaped, brick conduit. Two 60-in double-leaf wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection partially blocked and some sewage going to outlet. Heavy sludge build-up in regulator. Tide gates blocked open with trash. Substantial backflow at high tide.	51.1
20	Chelsea River near Chelsea Street Bridge	High outlet-type regulator and tide-gate chamber at Curtis Street, followed by 42-in x 44.5-in modified-circle, brick conduit. Two 24-in wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working satisfactorily. No sludge, no tidal effects. Tide gates not visible.	31.3
217	Clyde Street	12-in circ. vit. clay storm drain.	Dry	--
VI	Chelsea River at Byron Street	Regulator followed by 24-in conduit.	Not found	--
Charlestown				
21	Mystic River at Beacham Street	Abandoned 12-in x 12-in wood drain.	--	--
22	Mystic River at Malden Bridge	Abandoned 12-in conduit.	--	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Charlestown				
23	Mystic River at Beach Street extended	Sump-type regulator at Medford Street connected by 63-in x 66-in modified-circle, brick conduit to tidegate chamber followed by 63-in circ. brick conduit extended as 63-in circ. reinf. conc. conduit. One 60-in metal tide gate.	Dry weather connection working satisfactorily. Moderate sludge and debris in tidegate chamber. Tide gate leaks. Substantial backflow at high tide.	33.4
24	Little Mystic Channel at Elm Street extended	Abandoned 30-in x 36-in wooden conduit.	--	--
25	Little Mystic Channel near Starr-king Court extended	Weir-type regulator chamber at Medford Street followed by 24-in x 36-in rect. wood conduit. No tide gate.	Weir chamber working satisfactorily. No sludge.	20.2
26	Little Mystic Channel at Chelsea Street extended	Weir-type regulator and tidegate chamber in Chelsea Street at Medford Street followed by 30-in x 39-in egg-shaped, brick conduit extended as 30-in x 40-in horseshoe-shaped, brick conduit and 36-in x 40-in egg-shaped brick conduit in Chelsea Street. Two 36-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working satisfactorily. No sludge in regulator manhole. Tidegate chamber filled with debris. Tide gates missing. Substantial backflow and regulator surcharged at high tide.	11.4

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Charlestown				
27	Boston Harbor near Vine Street extended	Sump-type regulator at Vine Street connected by 48-in x 51-in modified-circle, brick conduit flowing in reverse to second high outlet-type regulator and tidegate chamber in Chelsea Street, followed by 46-in x 64-in brick conduit extended as 64-in x 92-in oval-shaped, brick conduit and 60-in circ. reinf. conc. conduit across Boston Naval Shipyard. Two 48-in double-leaf, wooden tide gates in series.	Dry weather connection working satisfactorily. Light sludge build-up. Upstream tide gate missing, downstream gate stuck open. Large timber in chamber. Substantial backflow at high tide.	66.2
28	Boston Harbor at Wapping Street extended (U.S.S. Constitution)	Sump-type regulator and tidegate chamber at Water Street followed by 48-in circ. brick conduit. Extended as 36-in x 36-in rect. conc. conduit. Two 48-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection plugged and all flow going to outlet. Heavy sludge build-up. Upstream tide gate stuck open. One leaf at downstream tide gate stuck open and other leaf lying in invert. Substantial backflow and regulator surcharged at high tide.	19.1
29	Boston Harbor at Grey Street (Hoosac Pier No. 1)	Sump-type regulator and tidegate chamber near Water Street followed by 48-in circ. brick conduit extended as 48-in circ. cast iron conduit. Two 48-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers in dry weather connection.	Dry weather connection plugged and all flow going to outlet. Tide gate stuck open. Regulator surcharged at high tide.	67.6

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Charlestown				
30	Boston Harbor at Warren Avenue Bridge	Sump-type regulator and tidegate chamber near Water Street followed by 30-in x 36-in brick conduit. One 36-in double-leaf, wooden tide gate followed by 36-in metal gate in series. Dry weather connection to outlet No. 32.	Dry weather connection working satisfactorily. Little or no sludge. Upstream tide gate stuck open. Downstream tide gate not tight. Substantial backflow at high tide.	14.1
32	Boston Harbor at Charles River Avenue extended (NE of Charlestown Bridge)	Sump-type regulator and tidegate chamber near Water Street, followed by 30-in x 36-in egg-shaped, brick conduit. Two 48-in double-leaf, wooden tide gates in series. Dry weather connection has stop-log and sheargate chambers and also serves outlet No. 30 through common sump.	Dry weather connection working satisfactorily. Light sludge in regulator. Heavy sludge at tidegate chamber outlet. Tide gates stuck partially open. Substantial backflow at high tide.	18.9
33	Millers River, across railroad yard from Front Street	Sump-type regulator and tidegate chamber followed by 30-in x 36-in egg-shaped, brick conduit extended as 18-in x 24-in rect. wood conduit. Two 36-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working satisfactorily. Light sludge. Tide gates stuck open. Substantial backflow at high tide.	9.8

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Charlestown				
34	Millers River across railroad yard from Front Street	Sump-type regulator and tidegate chamber followed by 24-in x 24-in rect. wooden conduit. One 24-in single-leaf, wooden tide gate followed by 24-in metal tide gate in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection working satisfactorily. Light sludge build-up. Tide gates fairly tight but some backflow.	20.6
35	Millers River across Dunstable Street extended	Sump-type regulator and two tidegate chambers in parallel at Rutherford Avenue followed by 72-in x 84-in U-shaped, conc. conduit, extended as 48-in x 60-in oval-shaped, wooden conduit and 72-in x 72-in rect. wooden conduit, and triple 48-in circ. reinf. conc. railroad culvert to Millers River. Two pairs of 48-in double-leaf, wooden tide gates in series. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection partially blocked and most flow discharging to outlet. Upstream gates inaccessible. One downstream gate stuck open. Regulator surcharged at high tide.	207.0
215	Millers River across railroad yard, Crescent Street extended	Sump-type regulator connected by 12-in circ. conduit to tidegate chamber, followed by 36-in circ. reinf. conc. conduit and railroad culvert to Millers River. 15-in metal tide gate.	Dry weather connection working satisfactorily. Heavy sludge in tidegate chamber.	19.5
216	Mystic River east of Malden Bridge (J.J. Ryan Jr. Playground)	15-in circ. reinf. conc. storm drain.	Dry	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Charlestown				
257	Mystic River west of Malden Bridge (south bank)	20-in circ. brick storm drain.	Not inspected	--
Brighton				
36	Charles River at Faneuil Station	9-in x 20-in wooden storm drain.	Not found	--
37	Charles River at Parson Street extended	High outlet-type regulator and tide-gate chamber followed by 60-in x 60-in rect. wooden conduit. Two 48-in double-leaf, wooden gates in series.	Dry weather working satisfactorily. Light sludge in sump but heavy build-up in tide-gate outlet. Large timbers in tide gate outlet. Frequent over-flows to river.	46.1
XII	Charles River near North Beacon Street extended at Birming-ham Parkway (Faneuil Valley Brook)	Weir-type regulator and tidegate chamber in Washington Street followed by 54-in circ. brick conduit in Fair-banks Street and easement, and in easement and Faneuil Street as 78-in x 90-in horseshoe-shaped brick conduit, and 84-in circ. conc. conduit, 132-in x 108-in horseshoe-shaped,	Dry weather flow retained in sewer. No sludge but sand on weir. Visible tide gate appears in good condition.	123.4

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Brighton				
XII (continued)		brick conduit, 99-in circ. conc. conduit, 144-in circ. brick conduit, and 152-in x 132-in horseshoe-shaped, brick conduit. Two 48-in double-leaf wooden tide gates.		
		Regulator and tidegate chamber in Faneuil Street, north of Newcastle Road and Harriet Street, discharging to outlet. Two 36-in double-leaf, wooden tide gates.	Regulator not accessible but dry weather flow retained in sewer. Visible tide gate badly deteriorated.	
		Regulator and tidegate chamber in Parsons Street, north of Faneuil Street, and Harriet Street, discharging to outlet. Two 36-in double-leaf, wooden tide gates.	Regulator not accessible, but heavy dry weather flow retained in sewer. Visible tide gate appears in good condition.	
		Regulator in North Beacon Street, at Vineland Street, followed by 30-in x 39-in ovoid-shaped, brick conduit, extended to outlet in 36-in circ. reinf. conc. conduit.	Dry weather connection working but some flow going to outlet.	
39	Charles River at Arsenal Street Bridge	Sump-type regulator followed by 30-in x 39-in brick conduit. Inverted siphon crossing structures and tidegate chamber on conduit. Two 36-in double-leaf, wooden tide gates in series.	Manholes surcharged. Tide gates not visible.	17.7

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Brighton				
40	Charles River south of Cambridge Street Bridge	Regulator (high point in sewer), extended as 36-in circ. reinf. conc. conduit. Tidegate chamber with single 36-in metal tide on 36-in conduit. Sump connection to MDC sewer at Seattle Street and Cambridge Street.	Some sewage discharging to outlet.	11.6
41	Charles River north of Babcock Street extended (Salt Creek)	Weir-type regulator and tidegate chamber near Ashford Street, followed by 90-in x 84-in horseshoe-shaped, conduit. Two 36-in double-leaf, wooden tide gates in series. Tributary sewers converted to separate sanitary system.	Dry weather connection working satisfactorily. No sludge. No signs of overflows. Upstream gates not visible. Downstream gates not working. Conditions at high river levels not known. Operating as storm drain.	--
XI	Charles River north of St. Mary's Street extended	Two sump-type regulators and two tidegate chambers at Commonwealth Avenue, followed by 90-in circ. reinf. conc. conduit. West tidegate chamber with two pairs of rect. wooden gates in series. East chamber with two rect. wooden gates in series.	Dry weather connections not visible. Substantial backflow in west chamber and regulator surcharged. East chamber not found.	78.9

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Brighton				
202	Charles River near North Beacon Street extended	30-in circ. reinf. conc. storm drain.	Not found	--
205	Charles River near Soldiers Field Road, at Lothrop Street	36-in circ. vit. clay storm drain.	Not found	--
207	Charles River at Telford Street extended (Shepard Brook)	66-in circ. conc. storm drain.	Quantity of rusty-colored water discharging to river.	--
208	Charles River near North Harvard Street extended (Larz Anderson Bridge)	36-in circ. brick storm drain.	Dry	--
211	Charles River at Armory Street extended	60-in circ. cast iron storm drain.	Sewage discharging to river.	--
214	Charles River at Raleigh Street extended	24-in circ. vit. clay storm drain.	Surface water	--
258	Charles River north of Western Avenue Bridge (west bank)	24-in circ. vit. clay storm drain.	Dry	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Roxbury				
43	Charles River at Deerfield Street extended (Muddy River Conduit)	Sump-type regulator and tidegate chamber at Commonwealth Avenue, followed by 108-in x 132-in oval-shaped, wood and concrete conduit. Two 60-in x 60-in rect. wooden tide gates in series. Second tidegate chamber near end of outlet with two 60-in x 108-in rect. wooden tide gates in parallel.	Dry weather connection working satisfactorily. No sludge visible. Tide gates tight.	15.0
246	Muddy River near Huntington Avenue (east bank)	45-in x 45-in U-shaped conc. storm drain.	Dry	--
247	Muddy River opposite Aspinwall Avenue extended	18-in circ. vit. clay storm drain.	Dry	--
248	Muddy River at Francis Street extended (east bank)	Storm drain.	Not found	--
250	Muddy River at Blackfan Street extended	30-in x 30-in horseshoe-shaped, concrete storm drain.	Small amount of clear water standing in outlet.	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
44	Charles River at Charlesgate West extended		Not found	--
45	Charles River at Charlesgate East extended	Weir-type regulator and tidegate chamber at Elmwood Street near Linden Park Street, followed by Old Stony Brook Conduit as 96-in x 72-in horseshoe-shaped reinf. conc. conduit to Hampshire Street, dual 99-in x 114-in rect. reinf. conc. conduit in Whittier Street, multiple culverts at Ruggles Street, dual 99-in x 126-in rect. reinf. conc. conduit in Forsyth Street to Boston Gate House No. 2 (Outlet No. S-2) and 84-in circ. brick and 84-in circ. concrete foul Channel to MDC Fens Gate House at Boston Marginal Conduit near end of outlet. Two rec. wooden tide gates in series at upstream tidegate chamber. Three sluice gates in parallel at Boston Gate House No. 2. One sluice gate and tide gate on outlet to Charles River Basin and one sluice gate to Marginal Conduit at MDC Fens Gate House.	Dry weather flow connection working satisfactorily. Moderate sludge. Tide Gate, visible at upstream chamber, appears in good condition.	2,270.0
		Sump-type regulator and tidegate chamber at Cabot and Vernon Streets followed by 40-in x 49-in ovoid-shaped brick conduit in Vernon Street to Old Stony Brook Conduit. Two 48-in double-leaf, wooden tide gates in series.	Dry weather connection blocked and all flow discharging to outlet. Moderate sludge. Visible tide gate stuck open in sludge.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		High outlet-type regulator at west corner of Shawmut Avenue and Vernon Street. 78-in circ. brick conduit in Shawmut Avenue, 90-in x 132-in horseshoe-shaped, brick conduit in Ruggles Street and Hampshire Street to Old Stony Brook Conduit. (Maywoods Brook Conduit)	Dry weather flow retained in sewer. No sludge.	
		Sump-type regulator and tidegate chamber at east corner of Shawmut Avenue and Vernon Street, discharging to Maywoods Brook Conduit. One double-leaf, wooden gate.	Dry weather connection partially blocked and some flow discharging to outlet. Moderate sludge. Tide gate appears in good condition.	
		Regulator and tidegate chamber at southeast corner of Ruggles Street and Shawmut Avenue discharging to Maywoods Brook Conduit. One tide gate.	Dry weather connection partially blocked and some flow discharging to outlet. Moderate sludge.	
		Sump-type regulator and tidegate chamber at north corner of Ruggles Street and Shawmut Avenue, discharging to Maybrook Conduit.	Dry weather connection working satisfactorily. Moderate sludge.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		High outlet-type regulator and tidegate chamber at Tremont Street and Whittier Street, discharging to Old Stony Brook Conduit. One double-leaf, wooden tide gate.	Dry weather connection blocked and all flow discharging to outlet. Heavy sludge. Tide gate stuck open in sludge.	
		Sump-type regulator and tidegate chamber in Ruggles Street at Forsyth Street, discharging to Old Stony Brook Conduit. Single 24-in metal tide gate visible.	Dry weather connection working satisfactorily, but manhole at downstream siphon chamber with 12-in connection to Old Stony Brook Conduit surcharged and 12-in tide gate not visible. Moderate sludge. 24-in tide gate appears satisfactory.	
		Sump-type regulator and tidegate chamber in Huntington Avenue discharging to east barrel of Old Stony Brook Conduit in Forsyth Street. Double-leaf, wooden tide gate. Stop-log and sheargate chambers on dry weather connection.	Dry weather connection surcharged and sewage discharging to outlet. Moderate sludge. Tide gate appears in good condition.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		Sump-type regulator and tidegate chamber at Parker Avenue, followed by inverted siphon under Commissioners Channels and extending northeasterly in Huntington Avenue as 36-in x 48-in egg-shaped brick conduit to west barrel of Old Stony Brook Conduit at Forsyth Street. Two 48-in double-leaf, wooden tide gates. Second tide-gate chamber at Forsyth Street outlet, with double-leaf, wooden tidegate. One low-level outlet, with sluice gate normally closed and one high-level outlet at siphon inlet (west) chamber, discharging to west barrel of Commissioners Channels at Parker Street. Additional sump-type regulator and dry weather connection in siphon outlet (east) chamber at Parker Street.	Both dry weather connections surcharged and appear to be blocked and heavy flow discharging to Old Stony Brook Conduit. Low-level outlet below water surface and position of sluice gate not known. High-level outlet not spilling. Moderate sludge.	
		Two 10-in connections from sanitary sewer to drain at Robert Street, east of Fairview Street.		
		High outlet type regulator and tidegate chamber in Woodman Street discharging from tributary of the Stony Brook Valley Sewer to Goldsmith Brook conduit	Dry weather flow retained in Woodman Street sewer. No sludge. Gate missing.	

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TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		in St. Joseph Street as 72-in x 72-in horseshoe-shaped brick conduit, and in South Street, easement, McBride Street and Rossmore Road as 102-in x 72-in horseshoe-shaped brick conduit, 72-in x 60-in horseshoe-shaped stone conduit, 102-in x 81-in horseshoe-shaped brick conduit, and 72-in x 72-in horseshoe-shaped stone conduit. This conduit discharges to Stony Brook Conduit which extends northerly in Meehan Street and Brookside Avenue as a 240-in x 192-in horseshoe-shaped reinf. conc. conduit to Green Street; northerly in easement and Columbus Avenue, parallel to the railroad, to Parker Street at Gurney Street and in Parker Street to Longwood Avenue in 204-in x 186-in horseshoe-shaped brick conduit (relieved part way by 114-in x 108-in horseshoe-shaped brick conduit in Amory Street, from Green Street to near Porter Street); northerly in Parker Street in twin 150-in x 144-in horseshoe-shaped brick conduits from Longwood Avenue to Huntington Avenue, diagonally across Forsyth Way, and in easement in 316-in x 162-in horseshoe-shaped brick conduit		

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		from Huntington Avenue to Boston Gate House No. 1 (Outlet No. S-1) west of Gate House No. 2; followed by 144-in x 144-in horseshoe-shaped, reinf. conc. foul flow channel to the MDC Fens Gate House at the Boston Marginal Conduit near end of outlet. Four automatic sluice gates in parallel at Boston Gate House No. 1. Two sets of three tide gates each in series at MDC Fens Gate House.		
		High outlet-type regulator and tidegate chamber at McBride Street, discharging from tributary of Stony Brook Valley Sewer to Goldsmith Brook Conduit in South Street. Double-leaf, wooden tide gate.	Dry weather flow retained in sewer. No sludge. Gate appears in good condition.	
		High outlet-type regulator and tidegate chamber at Washington Street, discharging from tributary of Stony Brook Valley Sewer to Goldsmith Brook Conduit in Rossmore Street. One 36-in double-leaf, wooden tide gate.	Small part of dry weather flow discharging to outlet. Heavy sludge in regulator. Gate appears to be deteriorated and stuck open.	
		High outlet-type regulator in Green Street, discharging from tributary of Stony Brook Valley Sewer to Stony Brook Conduit at Brookside Avenue.	Dry weather flow retained in sewer. No sludge.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		High outlet-type regulator in Green Street. Discharging from Stony Brook Valley Sewer to Stony Brook Conduit at Amory Street.	Dry weather flow retained in sewer. No sludge.	
		High outlet-type regulator in south side of Boylston Street, discharging from tributary of Stony Brook Valley Sewer to Stony Brook Conduit west of Amory Street.	Dry weather flow retained in sewer. Moderate sludge and signs of overflows.	
		High outlet-type regulator in north side of Boylston Street, discharging from tributary of Stony Brook Valley Sewer to Stony Brook Conduit west of Amory Street.	Inaccessible	
		High outlet-type regulator in easement, discharging from tributary of Stony Brook Valley Sewer to Stony Brook Conduit, 400 ft north of Boylston Street.	Inaccessible	
		High outlet-type regulator discharging from West Roxbury Low-level Sewer to Stony Brook Conduit at Hoffman Street.	Inaccessible	
		High outlet-type regulator discharging from tributary of Stony Brook Valley Sewer to Stony Brook Conduit at Hoffman Street.	Inaccessible	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		High outlet-type regulator in Amory Street at Centre Street (southeast connection) discharging from Stony Brook Valley Sewer to Stony Brook Conduit.	Dry weather flow retained in sewer. No sludge.	
		High outlet-type regulator in Amory Street at Centre Street (northeast connection, discharging from Stony Brook Valley Sewer to West Roxbury Low-Level Sewer.	Dry weather flow retained in sewer. No sludge.	
		High outlet-type regulator in Centre Street at Amory Street (west connection) discharging from tributary of Stony Brook Valley Sewer to Stony Brook Conduit.	Dry weather flow retained in sewer. No sludge.	
		High outlet-type regulator in Amory Street, 250 ft south of Ritchie Street, discharging from tributary of Stony Brook Valley Sewer to 48-in x 48-in horseshoe-shaped, brick conduit in easement as 72-in circ. reinf. conc. conduit to Stony Brook Conduit.	Dry weather flow retained in sewer. No sludge. Outlet not visible.	
		High outlet-type regulator in Columbus Avenue at Ritchie Street, discharging to tributary of Stony Brook Conduit. Described in previous paragraph.	Dry weather flow retained in sewer. No sludge. Outlet not visible.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		High outlet-type regulator in Centre Street at Columbus Avenue, discharging from tributary of Stony Brook Valley Sewer to Stony Brook Conduit.	Dry weather connection blocked and all flow discharging to outlet. Moderate sludge.	
		High outlet-type regulator in Columbus Avenue at Heath Street, discharging from Stony Brook Valley Sewer to 84-in x 120-in rect. brick west barrel of Old Stony Brook Conduit, and 60-in circ. brick conduit to Stony Brook Conduit.	Dry weather flow retained in sewer, but small freeboard.	
		High outlet-type regulator in Columbus Avenue at New Heath Street, discharging from Stony Brook Valley Sewer to 84-in x 120-in rect. brick west barrel of Old Stony Brook Conduit connected by 60-in circ. brick conduit to Stony Brook Conduit.	Inaccessible	
		High outlet-type regulator in New Heath Street at Columbus Avenue discharging from tributary of Stony Brook Valley Sewer to 84-in x 120-in rect. brick west barrel of Old Stony Brook Conduit connected by 60-in circ. brick conduit to Stony Brook Conduit.	Dry weather connection plugged and all flow discharging to outlet. Heavy sludge.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
45 (continued)		High outlet-type regulator in Cedar Street at Columbus Avenue, discharging from tributary of Stony Brook Valley Sewer to West Roxbury Low-Level Sewer.	Inaccessible	
		High outlet-type regulator in Columbus Avenue (east side) at Tremont Street (Roxbury Crossing), discharging from tributary to Stony Brook Interceptor to tributary of Old Stony Brook Conduit.	Dry weather flow retained in sewer. Moderate sludge.	
		Weir-type regulator in Tremont Street west of Columbus Avenue (Roxbury Crossing), discharging from tributary of Stony Brook Interceptor to Stony Brook Conduit.	Dry weather flow retained in sewer. No sludge.	
		Sump-type regulator in Columbus Avenue (west side) at Tremont Street (Roxbury Crossing), discharging from tributary of Stony Brook Interceptor to tributary of Old Stony Brook Conduit.	Dry weather connection plugged and all flow discharging to outlet.	
46 through 50	Charles River from Harvard Bridge to near Charles River Dam	Weir-type regulators, tidegate chambers and outlet conduits from MDC Boston Marginal Conduit to Charles River Basin.	Inaccessible	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
51	Not Operating	--	--	--
X-1	Charles River at Hereford Street extended, to Boston Marginal Conduit	Sump-type regulator and tidegate chamber at Beacon Street, followed by 51-in x 51-in rect. wooden conduit, extended as 51-in x 51-in rect. conc. conduit. Two 36-in metal tide gates in series. Sheargate chamber on each dry weather connection (2).	Dry weather connection blocked and all flow going to outlet. No sludge build-up visible. Tide gates working.	113.9
X-2	Charles River at Fairfield Street extended, to Boston Marginal Conduit	Sump-type regulator and tidegate chamber at Beacon Street, followed by 36-in x 48-in rect. wooden conduit, extended as 43-in x 43-in rect. wooden conduit. Two 36-in metal tide gates in series. Sheargate chamber on dry weather connection.	Dry weather connection blocked and all flow going to outlet. Moderate sludge build-up. Tide gates working.	76.3
X-3	Charles River at Dartmouth Street extended, to Boston Marginal Conduit	Sump-type regulator and tidegate chamber at Beacon Street, followed by 36-in x 48-in egg-shaped, brick conduit. Two 36-in metal tide gates in series. Sheargate chamber on dry weather connection.	Dry weather connection blocked and going to outlet. Moderate sludge build-up. Tide gates working . Regulator surcharged.	57.5

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
X-4	Charles River at Berkeley Street extended, to Boston Marginal Conduit	Sump-type regulator and tidegate chamber at Beacon Street, followed by 48-in x 60-in eggshaped, brick section. Two 36-in metal tide gates in series. Sheargate chamber on dry weather connection.	Dry weather connection blocked and all flow discharging to outlet. Moderate sludge build-up. Tide gates working.	100.4
X-5	Charles River, Beaver Place at Brimmer Street	Abandoned	--	--
X-6	Charles River, Beaver Street to Boston Marginal Conduit, via Beacon Street, Beaver Street and Beaver Place (outlet for Church Street Sewer)	Sump-type regulator opposite Brimmer Street, connected by 41-in x 53-in ovoid-shaped, brick conduit in Beacon Street to tidegate chamber at Beaver Street, followed by 48-in x 60-in rect. wooden conduit in Beaver Street, and 84-in x 96-in U-shaped, concrete conduit in Beaver Place. Two 36-in metal tide gates in series. Second tidegate chamber near end of outlet.	Dry weather connection working satisfactorily. Moderate sludge in tidegate chamber at Beacon Street. Some backflow through upstream tide gates at high tide. Tidegate chamber in Beaver Place not found.	69.4
X-7	Charles River at Mt. Vernon Street, to Boston Marginal Conduit	Weir-type regulator at River Street, followed by 36-in x 36-in U-shaped conc. conduit. Tidegate chamber with two 24-in metal tide gates in series near end of outlet.	Dry weather connection not visible, but appears to be working satisfactorily. Moderate sludge build-up. Upstream tide gate missing.	19.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Back Bay				
251	Back Bay Fens at Worthington Street extended (south bank)	24-in circ. vit. clay storm drain.	Drain surcharged with clear water. Outlet blocked.	--
252	Back Bay Fens at Kilmarnock Street extended (north bank)	15-in circ. vit. clay storm drain.	Clear water running in drain. Outlet not found.	--
Boston Northwest				
X-8	Charles River at Pinckey Street, to Boston Marginal Conduit	Weir-type regulator and tidegate chamber, followed by 42-in x 20-in U-shaped brick and wood conduit, extended as 24-in x 24-in rect. conc. conduit. Two 18-in metal tide gates in series.	Dry weather flow retained in sewer. Moderate sludge build-up. Upstream tide gate open. Downstream tide gate closed.	7.7
X-9	Charles River at Cambridge Street, to Boston Marginal Conduit	Sump-type regulator and tidegate chamber, followed by 60-in x 42-in brick conduit. Two 36-in metal tide gates in series.	Sump not visible. Dry weather connection apparently working satisfactorily. Upstream tide gate closed. Downstream tide gate off hinges and lying in bottom of chamber. Moderate sludge.	28.8
X-10	Charles River at Fruit Street, to Boston Marginal Conduit	Sump-type regulator and tidegate chamber at Charles Street, followed by 36-in x 30-in rect. wooden conduit. 24-in metal tide gate upstream. 24-in wooden tide gate downstream.	Dry weather connection working satisfactorily. Light sludge build-up. Tide gates open.	11.9

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Northwest				
X-11	Charles River in Charles Street, to Boston Marginal Conduit (formerly at Poplar Street, but not listed in House 1600)	Weir-type regulator and tidegate chamber north of Allen Street, followed by 30-in x 36-in conduit. Two 45-in x 45-in rect. wooden tide gates in series.	Dry weather flow retained in sewer. Light sludge build-up. Tide gates leak. Substantial backflow at high tide.	14.9
X-12	Charles River in Charles Street, to Boston Marginal Conduit (formerly at Chambers Street)	Weir-type regulator and tidegate chamber. Two 24-in metal tide gates in series.	Dry weather flow retained in interceptor, except for small discharge to outlets. Tide gates appear satisfactory.	10.1
52	Charles River, south of dam Lock (MDC)	Regulator at Boston Marginal Conduit extended.	Not inspected.	--
X-13	Charles River at Charles River Dam, to Boston Marginal Conduit (formerly Leverett Street)	24-in x 54-in U-shaped conc. storm drain.	Not inspected.	--
53	Charles River, north of Charles River Dam (MDC)	Boston Marginal Conduit Outlet.	Not inspected.	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Northwest				
54	Charles River, northwest of Nashua Street extended	Weir-type regulator at Causeway Street, followed by 72-in x 90-in rect. reinf. conc. conduit. Tidegate chamber near end of outlet with two 84-in x 81-in rect. wooden gates in series.	Dry weather flow retained in interceptor. No sludge build-up. Upstream tide gate closed. Downstream gate missing.	87.5
		Weir-type and high outlet-type regulators at Nashua Street connected directly to tidegate chamber.	Regulators working. No sludge build-up.	
		Weir-type regulator and tidegate chamber at Causeway Street, followed by 36-in x 60-in conc. conduit extending parallel to Causeway Street to Outlet No. 54 at Nashua Street. Two 36-in metal tide gates in series. (This was formerly Outlet No. 55 before being diverted to Outlet No. 54).	Peak dry weather flows spill to outlet. Light sludge build-up. Tide gates in good condition.	
55	Charles River at Canal Street extended	Abandoned. Diverted to Outlet No. 54. (See description above).	--	--
56	Charles River near Beverly Street and Warren Bridge	Weir-type regulator and tidegate chamber at Causeway Street, followed by 36-in circ. reinf. conc. conduit extended as 36-in circ. cast iron conduit. One 36-in metal tide gate.	Dry weather flow retained in interceptor. Tide gate in good condition.	14.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Northwest				
57	Charles River at Prince Street extended	Outlet abandoned.	Dry	--
58	Charles River at Prince Street extended	Sump-type regulator and tidegate chamber at Commercial Street, followed by 36-in x 36-in rect. wood conduit extended as 30-in x 12-in rect. wood conduit. Two 24-in metal tide gates.	Signs of frequent overflows. Heavy sludge build-up. Slight backflow at high tide.	49.1
59	Boston Harbor at Charter Street extended	Sump-type regulator and tidegate chamber at Commercial Street, followed by 16-in x 24-in rect. wood conduit. Two 24-in tide gates.	Dry weather connection blocked and flow going to outlets. Heavy sludge build-up. Both tide gates missing.	15.4
Boston Downtown				
60	Boston Harbor at Hanover Street extended	Sump-type regulator and tidegate chamber at Commercial Street, followed by 18-in x 24-in egg-shaped, brick conduit, extended as 18-in x 20-in egg-shaped,brick conduit. 36-in x 48-in rect. wooden conduit and 36-in circ. cast iron conduit. Two 24-in tide gates.	Dry weather connection working satisfactorily. Heavy sludge build-up indicates frequent overflows. One 24-in metal tide gate held open by sludge. One gate missing. Surcharged at high tide.	25.9

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Downtown				
61	Boston Harbor near Battery Street	Sump-type regulator and tidegate chamber near Commercial Street, followed by 24-in x 36-in egg-shaped, brick section, extended as 24-in x 36-in rect. wood conduit, and 24-in x 24-in rect. wood conduit. Two 24-in tide gates.	Dry weather connection working satisfactorily. Heavy sludge build-up indicates frequent over-flows. One 24-in metal tide gate working satisfactorily. One gate missing.	54.0
61A	Boston Harbor at Battery Street extended	Two storm drains	Dry	--
62	Boston Harbor near Clark Street extended	Sump-type regulator and tidegate chamber near Commercial Street, followed by 36-in x 36-in rect. wooden conduit. Two tide gates in series.	Dry weather connection not working and flow going to outlet. Moderate sludge build-up. Tide gates missing. Heavy timbers caught in tide-gate chambers.	4.4
63	Boston Harbor at Eastern Avenue extended	Storm drain	Dry	--
64	Boston Harbor at Clinton Street extended	Sump-type regulator, followed by 72-in x 60-in reinf. conc. conduit. Tidegate chamber on east side of Atlantic Avenue with two 60-in rect. wooden tide gates in series.	Substantial discharge of dry weather flow to Harbor at low tide. No backflow at high tide.	250.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Downtown				
65	Boston Harbor near State Street extended	Storm drain.	Dry	--
66	Boston Harbor near Central Street extended	Sump-type regulator, followed by 72-in x 72-in rect. reinf. conc. conduit. Tidegate chamber on east side of Atlantic Avenue with two 72-in x 72-in wooden tide gates in series. Stop-log chamber on dry weather connection.	Dry weather flow discharging directly to harbor at low tide. Gate chamber not accessible (buried under construction materials). Regulator surcharged at high tide.	41.4
67	Boston Harbor at Belcher Lane extended	Sump-type regulator and tidegate chamber, followed by 24-in x 24-in rect. wood conduit. Two 24-in tide gates.	Dry weather connection working satisfactorily. Manhole cover in sump. Heavy sludge build-up in tidegate chamber. One 24-in metal tide gate. One gate missing.	11.4
218	Fort Point Channel, Oliver Street extended	Sump-type regulator, extended as 54-in x 72-in rect. reinf. conc. conduit. Tidegate chamber with two 72-in x 54-in rect. wooden gates in series.	Sump surcharged. No sludge build-up seen. Tidegates appear satisfactory. Substantial discharge to outlet.	66.0
68	Fort Point Channel at Congress Street	Regulator (high point in outlet) and tidegate chamber near Gilbert Place, followed by 36-in x 36-in rect. wooden conduit. 36-in double-leaf, wooden tide gate upstream. 36-in metal tide gate downstream.	Dry weather flow discharging through outlet at low tide. Outlet surcharged at high tide.	10.3

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Downtown				
69	Fort Point Channel at Summer Street	Regulator (high point in outlet) and tidegate chamber near Dorchester Avenue, followed by 60-in brick conduit. Two 60-in double-leaf wooden tide gates.	Some dry weather flow discharging through outlet at low tide. Outlet surcharged at high tide.	36.0
70	Fort Point Channel at Kneeland Street extended	Sump-type regulator and tidegate chamber at Atlantic Avenue, followed by 81-in x 81-in horseshoe-shaped, brick conduit. Two pairs of tide gates in series near upstream end.	Dry weather connection working satisfactorily. No sludge. Some backflow through upstream pair of 36-in metal tide gates at high tide. Downstream pair of tide gate openings are planked up.	77.0
259	Fort Point Channel north of Congress Street Bridge (west bank)	24-in circ. vit. clay storm drain.	Not inspected.	--
Boston Southwest and South				
71	Fort Point Channel at Castle Street extended	8-in cast iron stormwater pumping station force main.	Not inspected.	--
72	Fort Point Channel near Troy Street extended	Sump-type regulator in Albany Street, extended as 72-in circ. reinf. conc. section. Two original 60-in rect. wooden tide gates in series.	Sump surcharged. Some backflow at high tide.	62.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Southwest and South				
73	Fort Point Channel at Dover Street extended	Regulator at Harrison Avenue, followed by 40-in x 49-in ovoid-shaped, brick conduit, extended as 48-in circ. reinf. conc. conduit. Tidegate chamber with two 48-in double-leaf wooden tide gates at upstream end of 48-in conduit.	Outlet blocked. Overflow line surcharged. Tide gates not visible.	32.0
74 through 83	Outlets tributary to Roxbury Canal Conduit and Dorchester Brook Conduit	For description of these outlets, see Outlet No. 219.	--	---
219	Fort Point Channel, Roxbury Canal Conduit outlet (Dorchester Brook Conduit tributary)	Roxbury Canal Conduit extends northeasterly as 204-in x 120-in rect. reinf. conc. conduit; 216-in x 120-in rect. reinf. conc. conduit, double 180-in x 120-in rect. reinf. conc. conduit; double 204-in x 120-in rect. reinf. conc. conduit; double 204-in x 150-in rect. reinf. conc. conduit; double 240-in x 186-in rect. reinf. conc. conduit, discharging to Fort Point Channel. Sump-type regulator and tidegate chamber, followed by 72-in x 78-in horseshoe-shaped, brick conduit in Massachusetts Avenue, from northwest (Outlet No. 79) Two 60-in rect. wooden tide gates.	Regulator surcharged but dry weather connection working satisfactorily. Moderate sludge in tidegate chamber. Upstream gate working. Downstream gate missing.	2,240.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Southwest and South				
219 (continued)		Sump-type regulator and tidegate chamber in Massachusetts Avenue from southeast (Outlet No. 80), followed by 48-in circ. brick conduit. Two 48-in x 48-in rect. wooden tide gates in series.	Regulator and tidegate chamber surcharged at low tide.	
		Not found (Outlet No. 78).	--	
		Regulator, followed by 81-in x 93-in horseshoe-shaped reinf. conc. conduit in E. Concord Street (Outlet No. 77). Tidegate chamber with two 81-in x 87-in rect. wooden tide gates in series at Albany Street.	Dry weather connection working satisfactorily. Moderate sludge. Upstream gate has fallen off and is laying in invert. Downstream gate works but leaks at high tide.	
		Sump-type regulator and tidegate chamber at E. Dedham Street, extended (Outlet No. 76), followed by 60-in x 72-in arch and scow bottom shaped brick conduit, extended as 60-in x 72-in rect. conc. conduit. 78-in x 92-in rect. wooden tide gate followed by 60-in metal tide gate.	Regulator manhole surcharged but dry weather connection appears to be working satisfactorily. Light sludge. Downstream tide gate timbered shut.	
		Union Park Street Pumping Station at Union Park Street extended (Outlet No. 75 , "low level") connected by 69-in x 63-in conc. force main to tidegate chamber at Albany Street, followed by 33-in x 126-in conc.	Station under repair. Tidegate chamber surcharged.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Southwest and South				
219 (continued)		conduit extended in 91-in x 126-in rect. reinf. conc. conduit (shared with Outlet No. 74). One 69-in x 54-in rect. wooden tide gate.		
		Sump-type regulator and tidegate chamber at Union Park Street extended (Outlet No. 74, "high level") at Albany Street, followed by 58-in x 126-in rect. reinf. conc. conduit, followed by 91-in x 126-in rect. reinf. conc. conduit. Two 88-in rect. wooden tide gates.	Regulator and tidegate chamber surcharged.	
		Sump-type regulator and tidegate chambers on Dorchester Brook Sewer at Massachusetts Avenue (Outlet No. 81), followed by Dorchester Brook Conduit as 142-in x 104-in, 142-in x 124-in and 144-in x 120-in horseshoe-shaped reinf. conc. conduit discharging to open channel at railroad crossing to double 204-in x 150-in rect. reinf. conc. conduit and double 204-in x 162-in rect. reinf. conc. conduit to Roxbury Canal Conduit. Two sets in series of four parallel 48-in x 72-in rect. wooden tide gates.	Dry weather connection partially blocked or too small, and constant flow being discharged to outlet. Some sludge. Tide gates missing or not working.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Boston Southwest and South				
219 (continued)		Sump-type regulators and tidegate chambers in Damrell Street, and D Street near Dorchester Avenue, (Outlet No. 82), followed by 90-in x 101-in horseshoe-shaped, reinf. conc. conduit to Dorchester Brook Conduit, except for short section of open channel at railroad crossing. Additional tidegate chamber on this outlet at upstream end of open channel. Damrell Street chamber has one 36-in rect. wooden tide gate; D Street chamber one 48-in rect. wooden tide gate; downstream outlet chambers have two 51.5-in x 101-in rect. wooden tide gates in parallel.	Dry weather connection working satisfactorily. Light sludge at regulators. Tidegate chamber in Damrell Street always surcharged at high tide. Tide gates in remaining chamber stuck open. Slight backflow at high tide.	
		Sump-type regulator in B Street and tidegate chamber west of Dorchester Avenue, (Outlet No. 83), followed by 72-in circ. brick conduit extended as 78-in x 94-in rect. conc. conduit, 72-in circ. brick conduit and 92-in x 78-in rect. conc. conduit to Dorchester Brook Conduit. Two 72-in x 72-in rect. wooden tide gates in series. Second tidegate chamber near end of outlet, with one 78-in x 92-in rect. wooden tide gate.	Dry weather connection working satisfactorily. Sludge condition not known. Tide gates in upstream chamber badly deteriorated and not working. Gate in downstream chamber missing.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
South Boston				
84	Fort Point Channel at West Fourth Street Bridge	Sump-type regulator and tidegate chamber at Foundry Street, followed by 24-in x 24-in rect. wooden section. Two 24-in circ. wooden tide gates in series.	Sump not visible but no dry weather flow discharging through tidegate chamber. Condition of gates not determined, but appear tight.	8.0
85	Fort Point Channel At Dorchester Avenue Bridge	High outlet-type regulator near Foundry Street, followed by 60-in circ. brick section. Tidegate chamber near end of outlet. Two 60-in double-leaf, wooden tide gates in series.	Dry weather connection working satisfactorily. No sludge build-up. Both gates not working. Substantial backflow at high tide.	28.0
86	Fort Point Channel at Mt. Washington Avenue	High outlet-type regulator and tidegate chamber, followed by 72-in circ. brick conduit. Two 36-in double-leaf, wooden tide gates in series. Tributary sewers converted to separate sanitary system.	Dry weather connection working satisfactorily. No sludge build-up. Downstream tide gates blocked open by heavy debris in chamber. Regulator surcharged and substantial backflow at high tide.	1.2
86A	Fort Point Channel at Summer Street Bridge (southeast end)	Storm drain outlet.	Dry	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
South Boston				
87	Fort Point Channel at Congress Street Bridge (southeast end)	Storm drain outlet.	Slight discharge - no odor.	--
220	Reserved Channel at F Street extended	High outlet-type regulator in West First Street, followed by 40-in x 60-in rect. wood conduit extended in D Street, extended as easement as 60-in circ. reinf. conc. and 60-in circ. iron conduits, 72-in circ. reinf. conc. conduit and 84-in circ. reinf. conc. conduit. Two 48-in double-leaf, wooden tide gates in series, in chamber near West First Street. Second tidegate chamber near outlet.	Dry weather flow retained in interceptor. Moderate sludge build-up in upstream tidegate chamber. Upstream tide gate in upstream chamber not accessible. Downstream gate not tight. Regulator surcharged at high tide. Downstream tidegate chamber not found. (Area under development).	39.1
		High outlet-type regulator and tidegate chamber in D Street, West of Cypher Street, connected to outlet. Two 48-in x 60-in rect. wooden tide gates in series.	Dry weather connection working satisfactorily. Moderate sludge build-up. Gates not tight. Regulator surcharged and some backflow at high tide.	
		Sump-type regulator and tidegate chamber in F Street extended as 48-in circ. reinf. conc. conduit. Two double-leaf, wooden tide gates in series.	Dry weather connection working satisfactorily. No sludge build-up seen. Tide gates missing.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
South Boston				
220 (continued)		Sump-type regulator in East First Street connected to regulator above.	Dry weather connection working satisfactorily.	
89	Reserved Channel at Claflin Street extended	24-in vit. clay surface drain at E Street.	Dry	--
90	Reserved Channel at I Street extended	High outlet-type regulator and tidegate chamber at East First Street, followed by 36-in x 42-in arch and scow bottom shaped, brick and wood conduit. Two 48-in double-leaf, wooden tide gates in series.	Dry weather connection on I Street working satisfactorily. Moderate sludge in all structures. Gates stuck open. Regulator surcharged at high tide.	24.7
		High outlet-type regulator to southeast of intersection and connected to above tidegate chamber.	Dry weather connection blocked and flow discharging to outlet. Regulator surcharged at high tide.	
91	Reserved Channel at Summer Street (from East First Street)	Sump-type regulator and tidegate chamber at East First Street, followed by 24-in x 30-in egg-shaped, brick conduit, extended as 30-in circ. reinf. conc. conduit, and 60-in circ. brick conduit. Two 24-in metal tide gates. Second tidegate chamber near outlet with 30-in metal tide gate. Pumping Station on Edison Electric Company property discharges to 30-in pipe.	Dry weather connection working satisfactorily. Moderate sludge and some debris in sump. Sludge in gate chamber. Gates working but regulator surcharged at high tide.	3.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
South Boston				
92	Reserved Channel at Farragut Road extended	Sump-type regulator and tidegate chamber in East First Street, followed by 60-in brick conduit to Farragut Road and extended in Farragut Road as 72-in x 72-in U-shaped conc. conduit. Additional tidegate chamber at upper end of 72-in x 72-in conduit. One 24-in metal tide gate at East First Street chamber and two 78-in x 72-in rect. wooden tide gates at Farragut Road.	Dry weather connection completely blocked and all flow discharging to outlet. Tide gates working.	37.8
		Sump-type regulator in East Second Street, followed by 30-in x 36-in U-shaped, conc. conduit in Farragut Road to outlet at East First Street.	Dry weather connection in Farragut Road and Marine Park to East Sixth Street, partially blocked and substantial flow discharging to outlet.	
93	Old Harbor, Farragut Road extended	Sump-type regulator and tidegate chamber at Sixth Street, followed by 30-in circ. cast-iron conduit. Single 18-in diameter metal tide gate.	Dry weather connection working satisfactorily. Light sludge in sump. Small leak through tide gate.	7.3
94	Old Harbor, N Street extended	Sump-type regulator and tidegate chamber at Day Boulevard, followed by 36-in x 48-in egg shaped, brick conduit, extended as 48-in circ. cast-iron conduit. Two double-leaf wooden tide gates in series.	Grit and regulator sumps, and dry weather connection plugged. Tide gates missing except for one leaf. All sewage discharging through outlet.	33.7

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
South Boston				
95	Old Harbor, K Street extended	Sump-type regulator at Marine Road, followed by 24-in x 27-in ovoid-shaped, brick conduit, extended as 36-in circ. brick and 36-in circ. iron conduit. No tidegate chamber	Dry weather connection working satisfactorily. Heavy sludge in sump.	4.8
96	Old Harbor, H Street extended	Sump-type regulator and tidegate chamber at Marine Road, followed by 60-in circ. brick conduit, extended as 60-in circ. cast-iron conduit. 60-in double-leaf, wooden tide gate upstream and 60-in metal tide gate downstream in series.	Dry weather connection working satisfactorily. Sump clear. One timber gate leaf stuck closed. Leak in metal tide gate.	150.8
		Weir-type regulator at East Eighth Street, followed by 18-in circ. vit. clay conduit in I Street extended as 24-in x 36-in U-shaped conc. conduit.	Sanitary flow from I Street, entering from connections below regulator at East Eighth Street. I Street regulator retaining dry weather flow.	
97	Old Harbor, Rev. R.A. Burke Street extended (formerly Vale Street)	Sump-type regulator and tidegate chamber at Marine Road, followed by 78-in circ. brick conduit, extended as 78-in x 78-in rect. reinf. conc. conduit, and double 60-in circ. cast-iron conduits, in parallel. Two 48-in double-leaf wooden tide gates in series. Flushing gate chamber at end of 78-in x 78-in conduit with two 48-in x 60-in gates.	Sump clear. Dry weather connection working satisfactorily. One leaf of upstream gate stuck open. Some backflow through tide gates, as clear water. Sluice gates in flushing chamber closed.	108.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
South Boston				
98	Old Harbor, Kemp Street extended	Sump-type regulator and tidegate chamber at Henry Sterling Square, followed by 124-in x 75-in horse-shoe-shaped brick and 124-in x 75-in horseshoe-shaped reinf. conc. conduit, extended as triple 60-in circ. cast-iron conduit. Two pairs of double 60-in x 60-in rect. wooden tide gates in series. Flushing gate chamber at end of 124-in x 75-in conduit with three 60-in x 48-in gates.	Flow discharging to interceptor at low tide and to outlet on falling tide. Substantial back flow through tidegate chamber on rising tide. Gates inoperative or missing.	60.0
		South regulator sump and tidegate chamber at Old Colony Avenue, followed by connection to 124-in x 72-in outlet conduit. Two 36-in double-leaf, wooden tide gates in series.	Heavy sludge in sump. Connection to interceptor plugged. All dry weather flow going to outlet. Both gates stuck partially open.	
		North regulator sump and tidegate chamber at Old Colony Avenue, followed by connection to 124-in x 72-in outlet conduit. Two 60-in double-leaf, wooden tide gates in series.	Sump and dry weather connection working satisfactorily at low tide. Surcharged at high tide. Both gates stuck partially open.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
South Boston				
99	Old Harbor, Mt. Vernon Street extended	Weir-type regulator at Morrissey Blvd., followed by 60-in circ. conc. conduit extended as an 84-in x 84-in rect. reinf. conc. conduit, 62-in x 116-in rect. wooden conduit and another 84-in x 84-in circ. reinf. conc. conduit, 120-in x 120-in rect. reinf. conc. conduit, and double 84-in x 96-in rect. reinf. conc. conduit. Tide gate structure located at downstream end of 120-in x 120-in conduit with two pairs of 90-in x 96-in rect. wooden tide gates in series.	Weir clean. All dry weather flow to interceptor at low tide. Substantial backflow through tide gates stuck open and in very poor condition.	550.0
		Weir-type regulator on Crescent Avenue, followed by 45-in circ. conc. conduit in Carson Street, extended as 51-in circ. brick conduit, 78-in circ. brick conduit and 96-in x 96-in rect. reinf. conc. conduit to outlet described above.	Dry weather flow retained interceptor. Regulator clean.	
		Weir-type regulator at Crescent Avenue, followed by 48-in circ. brick conduit in Sidney Street to conduit at Carson Street. Tidegate chamber with two 48-in double-leaf wooden tide gates in series near end of conduit.	Dry weather flow spilling to outlet. Tide gates stuck open. Moderate sludge in chamber.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Dorchester				
100	Dorchester Bay, Freeport Way extended (Dorchester Yacht Club)	Weir-type regulator at overflow structure east of railroad diverts excess flow from Outlet No. 101 and discharges it through two 78-in circ. reinf. conc. conduits in parallel, extended as two 84-in circ. cast-iron conduits in parallel. Overflow structure has long side-weir, outlet channel, and tidegate chamber with two 96-in x 72-in rect. wooden tide gates in parallel. Second tidegate chamber with two 78-in metal tide gates in parallel at upstream end of 84-in conduits.	Condition of upstream tidegate chamber indicates frequent overflows. Both sets of tide gates working satisfactorily.	(See Outlet No. 101)
101	Dorchester Bay, South of Savin Hill to Fox Point (Freeport Street Brook)	High outlet-type regulator and tide-gate chamber at Bowdoin Street, followed by 54-in circ. brick conduit, extended as 72-in circ. brick conduit in easement, parallel to Hancock Street, to east of Dorchester Avenue, in easement as 96-in x 162-in horse-shoe-shaped, brick conduit, 144-in x 132-in horseshoe-shaped, reinf. conc. conduit, 168-in x 130-in U-shaped conc. conduit to overflow structure at Outlet No. 100. Downstream in 96-in x 120-in rect. reinf. conc. conduit to tidegate chamber at Fox Point, east of Morrissey Boulevard; followed by two 90-in x 82-in rect. reinf. conc. conduits in parallel.	Dry weather connection working satisfactorily. Only one gate remains at Fox Point chamber.	372.0

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Dorchester				
101 (continued)		One 18-in circ. wooden tidegate at Bowdoin Street and two pairs of 90-in x 82-in rect. wooden tide gates in series at Fox Point chamber.		
		High outlet-type regulator and one 18-in circ. wooden tide gate in Hancock Street, at High Street, discharging to outlet.	Dry weather connection working satisfactorily.	
		Sump-type regulator and tidegate chamber at Dorchester Avenue north of Hoyt Street to outlet conduit. Two 60-in double-leaf, wooden tide gates in series. 24-in circ. vit. clay dry weather connection, with tide gate.	Dry weather connection working satisfactorily at low tide. Moderate sludge in sump and chamber. Tide gates stuck open, or missing. Heavy backflow on rising tide and raw sewage discharging to outlet on falling tide.	
		Sump-type regulator in Hancock Street, followed by 48-in x 48-in rect. conc. conduit extending northerly in Dorchester Avenue to regulator described above. Tidegate chamber on conduit with two 60-in rect. wooden tide gates in series.	Dry weather connection partially blocked and substantial sewage flow discharging to outlet at low tide. Moderate sludge build-up in regulator and chamber. Tide gates working satisfactorily. Interceptor surcharging at high tide.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
	Dorchester			
101 (continued)		High outlet-type regulator at Savin Hill Avenue, followed by 64-in x 68-in then 64-in x 72-in rect. reinf. conc. conduits in series in Auckland Street to outlet. Tidegate chamber at outlet with two 72-in wooden tide gates in series.	Not observed.	
		High outlet-type regulator on Dorchester Interceptor at Auckland Street connected to outlet at two places; 12-in circ. vit. clay conduit to West and tidegate chamber with two 60-in double-leaf, wooden tide gates to East.	Flow retained in sewer at low tide. Light sludge. Surcharged at high tide.	
		Sump-type regulator and tidegate chamber on Freeport Street, near Kimball Street, followed by 84-in circ. brick conduit to outlet. Two pairs of 48-in double-leaf, wooden tide gates in series.	Dry weather connection working satisfactorily at low tide. No sludge build-up in sump or chamber. Tide gates stuck open. Heavy backflow on rising tide and raw sewage discharging on falling tide.	
		Sump-type regulator and tidegate chamber on Freeport Street, at Kimball Street, extended to 84-in conduit above. Two 48-in double-leaf, wooden tide gates in series.	Dry weather connection working satisfactorily at low tide. Tide gates stuck open. Substantial backflow and regulator manhole surcharged at high tide.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Dorchester				
102	Not operating (combined with Outlet No. 101)	--	--	--
103	Neponset River, Tenean Bay near Victory Road (Tenean Creek)	High outlet-type regulator on Geneva Avenue at Waldeck Street, followed by 63-in x 63-in horseshoe-shaped, brick conduit, extended as 96-in x 78-in horseshoe-shaped, brick conduit, 96-in x 72-in horseshoe-shaped brick conduit, 168-in x 144-in horseshoe-shaped, brick conduit and 168-in x 138-in horseshoe-shaped conc. conduit and 144-in x 144-in horseshoe-shaped reinf. conc. conduit to Southeast Expressway; followed by 144-in x 180-in rect. reinf. conc. conduit to end of outlet.	Dry weather flow retained in interceptor. No sludge.	500.0
		Weir-type regulator at Park Street, followed by 42-in circ. brick conduit in Marlowe Street, and easement to outlet conduit.	Dry weather flow retained in sewer. Light sludge indicates recent overflows.	
		Weir-type regulator and tidegate chamber at Park Street east of Geneva Avenue. One double-leaf, wooden tide gate.	Dry weather flow spilling to interceptor. Moderate sludge. Sewer may be partially blocked by deposits downstream. Tide gate stuck open.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Dorchester				
103 (continued)		High outlet-type regulator at Gibson Street, near Bispham Street, followed by 18-in circ. vit. clay conduit in easement to outlet conduit.	Not found.	
		Weir-type regulator and tidegate chamber on Adams Street at Christopher Street. 36-in double-leaf, wooden tide gate.	Dry weather flow retained in sewer. Light sludge. Tide gates missing.	
		Regulator and siphon chamber on side of interceptor in Sturtevant Street, to divert flows to Tenean Creek conduit at Christopher Street.	Siphon inlet structure surcharged. Heavy scum. Regulator not found.	
		High outlet-type regulator on Park Street, near Clayton Street, followed by 48-in x 48-in rect. wooden conduit extending to outlet conduit.	Regulator surcharged. Overflow outlet not visible.	
		Sump-type regulator at Houghton Street, followed by 48-in circ. brick conduit in Victory Road to outlet conduit. Tidegate chamber near outlet conduit with 36-in metal gate.	Dry weather connection working but some flow discharging to outlet. Moderate sludge build-up in sump and chamber. Tide gate closed but interceptor surcharged at high tide.	
		Weir-type regulator at Gibson Street, followed by 30-in x 42-in egg-shaped, brick conduit in Dorchester Avenue to outlet conduit.	Dry weather flow retained in sewer. Some sludge indicated recent overflow.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
104	Neponset River at Ericson Street extended	Regulator and tidegate chamber followed by 15-in circ. vit. clay conduit. Metal tide gate.	Interceptor plugged up downstream and flow discharging to outlet. Heavy sludge build-up in sump and chamber. Sump surcharged at high tide.	3.0
105	Neponset River at Tenean Street west of Lawley Street (Fine Neck Creek)	Storm drain outlet with 72-in metal tide gate extended as 72-in circ. reinf. conc. conduit.	Dry. Tide gate in good condition.	--
106	Neponset River at Neponset Bridge	Sump-type regulator and tidegate chamber at Craddock Street, followed by 36-in x 48-in egg-shaped, brick conduit in Neponset Avenue, extended as 36-in x 42-in arch and scow bottom, brick and wood conduit, and tidegate chamber, followed by 48-in circ. reinf. conc. outlet conduit. 48-in double-leaf, wooden tide gate followed by 36-in metal tide gate.	Dry weather connection plugged and sewage discharging to outlet. Moderate sludge build-up in sump and chamber. Wooden gate stuck partially open. Metal gate working satisfactorily.	30.0
		Weir-type regulator and tidegate chamber at Walnut Street, followed by 30-in x 36-in arch and scow bottom, brick and wood conduit extending in Taylor Street to upstream end of 36-in x 42-in conduit mentioned above. 36-in double-leaf, wooden tide gate followed by 30-in metal tide gate.	Weir not effective and sewage discharging to outlet. Light sludge build-up at regulator and chamber. One leaf of wooden tide gate in invert. Metal tide gate appears satisfactory.	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Dorchester				
107	Neponset River on Hallet Street (Davenport Brook)	High outlet-type regulator and tide-gate chamber at Fuller Street near Clermont Street, followed by 54-in circ. brick, 48-in circ. reinf. conc. 84-in x 90-in rect. reinf. conc., 88-in x 90-in rect. reinf. conc. 66-in x 132-in rect. reinf. conc. and two 74-in x 93-in rect. reinf. conc. conduits. One 18-in wooden tide gate.	Dry weather flow retained in interceptor. No sludge. Tide gate stuck open. Above tidal influence.	300.0
		Weir-type regulator and tidegate chamber at Adams Street, near Minot Street, connected directly to outlet conduit, described above. One 24-in metal tide gate.	Some dry weather flow spilling to outlet. Some sludge in tidegate chamber. Tide gate tight.	
		Weir-type regulator and tidegate chamber on interceptor in Hallet Street, near end of outlet. Two 48-in double-leaf, wooden tide gates.	Water in regulator stationary. Tide gates not visible.	
108	Neponset River, Hilltop and Lenoxdale Street	36-in concrete storm drain outlet.	Dry	

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Dorchester				
109	Neponset River at Granite Avenue extended	Weir-type regulator connected by inverted siphon to tidegate chamber, followed by 36-in x 48-in egg-shaped, brick conduit. 48-in double-leaf, wooden tide gate, followed by 36-in metal tide gate.	Some dry weather flow discharging to outlet at low tide. Substantial flow discharging at high tide. Moderate sludge build-up in regulator and chamber. Part of wooden tide gate missing.	39.6
221	Dorchester Bay, cove at Savin Hill Avenue (North)	24-in circ. vit. clay storm drain.	Dry	--
222	Dorchester Bay, Malibu Beach cove at Denny Street extended	30-in circ. cast iron storm drain.	Sewage discharging to outlet.	--
223	Dorchester Bay, Malibu Beach cove at Dorchester Yacht Club	36-in circ. reinf. conc. storm drain.	Not inspected.	--
224	Neponset River at Mellish Road extended	High outlet-type regulator, followed by a 34-in x 24-in rect. reinf. conc. outlet conduit.	Dry	--
225	Neponset River at Bearse Avenue extended	15-in circ. vit. clay storm drain.	Dry	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Dorchester				
226	Neponset River at Adams Street and Dorchester Avenue	30-in x 24-in rect. stone.	Dry	--
227	Neponset River, east of Central Avenue Bridge	30-in circ. vit. clay storm drain.	Small discharge of clear water to outlet.	--
228	Neponset River at Blue Hill Avenue	72-in circ. brick storm drain.	Small discharge of clear water outlet.	--
229	Neponset River south of River Street at Edgewater Drive	102-in x 72-in horseshoe-shaped, brick storm drain.	Small discharge of water at outlet.	--
230	Neponset River near Osceola Street	21-in circ. vit. clay storm drain.	Dry	--
231	Neponset River at Belnel Road extended	24-in circ. cast iron storm drain with metal tide gate on end.	Dry	--
232	Neponset River west of Wood Avenue extended	69-in circ. conc. storm drain.	Small discharge of clear water at outlet.	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
Hyde Park				
233	Neponset River near Rosa Street extended	48-in circ. conc. storm drain.	Small discharge of clear water at outlet.	--
234	Neponset River at West Street extended (north bank)	30-in circ. conc. storm drain.	Dry.	--
235	Neponset River at Erie Street extended (south bank)	24-in circ. vit. clay storm drain.	Small amounts of clear water discharging to outlet.	--
236	Neponset River at Walter Street extended (north bank)	30-in circ. corrugated-metal storm drain.	Dry.	--
237	Neponset River at Milton Avenue extended (south bank)	Sanitary sewer regulator with sluice gate.	Dry. Gate closed.	--
238	Neponset River at Warren Avenue extended (south bank)	24-in circ. vit. clay storm drain.	Small amounts of sewage discharging to outlet.	--
239	Neponset River near Fairmount Avenue Bridge (north bank)	24-in circ. vit. clay storm drain.	Dry.	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
240	Neponset River at Fairmount Avenue bridge (south bank)	24-in circ. vit. clay storm drain.	Dry.	--
241	Neponset River at Williams Avenue extended (south bank)	33-in circ. conc. storm drain.	Small amounts of clear water discharging to outlet.	--
242	Neponset River at Mason Street extended (north bank)	18-in circ. vit. clay storm drain.	Dry.	--
243	Neponset River at Reservation Road extended (north bank)	24-in circ. vit. clay storm drain.	Dry.	--
244	Neponset River at Cranmore Road extended (west bank)	54-in circ. reinf. conc. storm drain.	Not inspected.	--
West Roxbury				
245	Charles River near Stimson Street extended	126-in x 126-in rect. reinf. conc. storm drain discharging to paved channel.	Dry except for ground-water pumped from adjacent construction site.	--
245A	Charles River north of Spring Street	30-in circ. vit. clay storm drain.	Not inspected.	--

TABLE 1 CONDITION AND CAPACITY OF EXISTING OUTLETS
(continued)

Outlet No.	Location	Description of Outlet	Observed Condition	Estimated Capacity (mgd)
West Roxbury				
255	Charles River via Brook Farm Brook and Baker Street Brook at Capital Street extended (St. Joseph's cemetery)	36-in circ. reinf. conc. storm drain.	Dry.	--
256	Charles River via Brook Farm Brook near Newfield Street extended west of LaGrange Street (St. Joseph's cemetery)	120-in x 80-in rect. reinf. conc. storm drain.	Dry.	--

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
14	-	East Boston	Chelsea & Byron Sts.	(reported to be abandoned)		
15	23	East Boston	Addison Street Pumping Station	276.0	39x54 oval	14.827
16	25	East Boston	Saratoga St. 100 ft W. of Bennington	1.2	10	0.704
17	18	East Boston	Saratoga & Bennington Sts.	72.0	24	4.061
18	2	East Boston	Barnes Ave. & Saratoga St.	47.2	12	1.015
19	27	East Boston	612 ft W. of Riverside	23.6	18	2.284
20	14	East Boston	Marginal & Ruth Sts.	11.8	12	1.015
21	15	East Boston	Marginal & Cottage Sts.	13.0	12	1.015
22	3	East Boston	Condor & Meridian Sts.	23.6	15	1.586
23	5	East Boston	Condor & Meridian Sts.	2.0	12	1.015
24	8	East Boston	Border St. S. of Eutaw St.	29.5	15	1.586
25	7	East Boston	Border St. S. of Lexington St.	11.8	12	1.015
26	9	East Boston	New & Sumner Sts.	11.8	12	1.015
27	6	East Boston	Border, 195 ft N.E. of Decatur	33.0	15	1.586

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)
Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
28	16	East Boston	Eagle Square	59.0	18	2.284
29	24	East Boston	Eagle Square	29.5	15	1.586
30	6	Charlestown	Roland & Crescent Sts.	3.0	12	1.015
31	1	Charlestown	Alford St.	14.8	15	1.586
32	4	Charlestown	Chelsea & Medford Sts.	41.3	24	4.061
33	2	Charlestown	Chelsea & Vine Sts.	59.0	15	1.586
34	13	Charlestown	Chelsea & Vine Sts., No. side	3.5	15	1.586
35	3	Charlestown	Water & Wapping Sts.	17.7	15	1.586
36	9	Charlestown	Water St. 20 ft W. of Gray St.	23.6	15	1.586
37	15	Charlestown	Water St. 25 ft W. of Gray St.	1.8	12	1.015
38	10	Charlestown	Water St. 95 ft W. of Charles River Ave.	13.6	12	1.015
39	7	Charlestown	Front St. 140 ft N.E. of Mason St.	11.8	12	1.015
40	8	Charlestown	Front St. 100 ft E. of Union St.	5.9	12	1.015

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
41	14	Charlestown	Rutherford Ave. 35 ft N. of Miller	-	12	1.015
42	5	Charlestown	Rutherford Ave. 35 ft S. of Dunstable	118.0	24	4.061
43	11	Charlestown	Main and Beech Streets	79.7	18	2.284
44	12	Charlestown	Arlington and Hamblen Streets	3.5	12	1.015
45	7	West Roxbury	Corey Street	109.0	12	1.015
46	2	West Roxbury	Corey Street	17.7	12	1.015
47	21	West Roxbury	Corey St., N.W. of Maple St. Ext.	18.9	10	0.704
48	16	West Roxbury	Worley St. 265 ft S. of Brook Farm Rd.	3.0	10	0.704
49	20	West Roxbury	Worley St. 270 ft S. of Brook Farm Rd.	3.0	10	0.704
50	24	West Roxbury	Bonair Street	21.8	12	1.015

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
51	32	West Roxbury	VFW Pkwy. at Lyall Street	2.4	10	0.704
52	14	West Roxbury	VFW Pkwy. at Caspar Street	7.7	10	0.704
53	18	West Roxbury	VFW Pkwy near Caspar Street	8.3	10	0.704
54	28	West Roxbury	VFW Pkwy. at Newfield Street	5.9	10	0.704
55	30	West Roxbury	VFW Pkwy. at Newfield Street	5.9	10	0.704
56	26	West Roxbury	Newfield St., 165 ft S.E. of Br. Farm Rd.	0.3	10	0.704
57	34	West Roxbury	Brook Farm Rd. at Newfield Street	10.0	10	0.704
58	31	West Roxbury	Lagrange St. at Brook Farm Rd.	3.0	10	0.704
59	1	West Roxbury	Lagrange St. at Brook Farm Rd.	153.0	12	1.015
60	27	West Roxbury	Lagrange St., 1000 ft N. of Br. Farm Rd.	4.7	10	0.704

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
61	23	West Roxbury	Baker St. 600 ft N. W. of Br. Farm Rd.	13.5	15	1.586
62	15	West Roxbury	VFW Pkwy and Farragut St.	65.0	15	1.586
63	11	West Roxbury	Gardner St at Rivermoor Street	5.9	10	0.704
64	35	West Roxbury	Gardner St. at Rivermoor Street	3.5	12	1.015
65	3	West Roxbury	Gardner St . S. W. of VFW Pkwy.	207.0	15	1.586
66	13	West Roxbury	Spring Street at VFW Pkwy.	66.7	12	1.015
67	17	West Roxbury	425 ft N. of Dedham-Boston line	197.5	27	5.139
68	37	West Roxbury	In Dedham, at East and Curve Streets	171.0	24	4.061
69	25	West Roxbury	Colburn St. 237 ft S.W. of Emmet	71.0	18	2.284
70	19	West Roxbury	Private land off South Street	0.5	10	0.704

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
71	22	West Roxbury	South St. 1000 ft N. of Bussey St.	126.0	24	4.061
72	8	West Roxbury	Washington St. 450 ft No. of Whipple Ave.	1250.0	36 x 48 egg	12.081
73	4	West Roxbury	Hyde Park Avenue at Larch Place	6.5	12	1.015
74	5	West Roxbury	Hyde Park Avenue 600 ft S. of Mt. Hope St.	39.5	12	1.015
75	6	West Roxbury	Hyde Park Avenue 600 ft S. of Mt. Hope St.	7.1	12	1.015
76	12	West Roxbury	Harding Rd. and Hadwin Way	4.7	10	0.704
77	10	West Roxbury	Canterbury Street near Ashland Street	166.0	15	1.586
78	9	West Roxbury	Private land Canterbury and Ashland	1131.9	51	18.337
79	36	West Roxbury	Private land off Wilmot Street	1.8	10	0.704
80	19	Hyde Park	W. River Street and Fairview Avenue	85.5	12	1.015

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
			Public Connections			
81	13	Hyde Park	West River St. 413 ft S.W. of Church St.	2.3	8	0.451
82	9	Hyde Park	West River Street, 133 ft W. of Church St.	29.5	8	0.451
83	7	Hyde Park	Business St. and Reservation Road	1.5	12	1.015
84	6	Hyde Park	Business St. and Barry Street	77.5	15	1.586
85	4	Hyde Park	Hyde Park Avenue and Factory Street	49.0	12	1.015
86	5	Hyde Park	Hyde Park Ave. and Factory Street	96.0	20	2.820
87	11	Hyde Park	Walnut St. and Bridge Street	124.0	15	1.586
88	8	Hyde Park	Walnut St. near R. R.	0.5	8	0.451
89	1	Hyde Park	Fairmont Avenue and River St.	27.1	12	1.015
90	2	Hyde Park	Milton Ave. Ext. near River St.	260.0	18	2.284

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
91	3	Hyde Park	Arlington St & Metropolitan Ave.	90.0	15	1.586
92	10	Hyde Park	Off River St. near Rosa Street.	63.7	12	1.015
93	12	Hyde Park	E. River St., 280 ft W. of Wood Ave.	82.5	15	1.586
94	-	Hyde Park	Wood Ave & River Street	23.0	12	1.015
95	18	Hyde Park	River St. 70 ft W. of Holmfield St.	3.0	15	1.586
96	15	Hyde Park	Off Newburn St.	420.0	24	4.061
97	16	Hyde Park	Ruskin Rd. near Ralston Road	59.0	12	1.015
98	17	Hyde Park	M.D.C. land near foot of Monponsett St.	8.8	8	0.451
99	14	Hyde Park	Monponsett St. 600 ft S. of River St.	32.5	12	1.015
100	20	Hyde Park	Neponset Valley Pkwy at Neponset River	37.0	18	2.284

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
101	19	Brighton	20 ft E. of Newton-Boston line	1.2	10	0.704
102	11	Brighton	Brooks Street	38.3	12	1.015
103	9	Brighton	Parsons Street	538.0	24	4.061
104	15	Brighton	No. Beacon Street	0.5	10	0.704
105	20	Brighton	Soldiers Field Rd. & Birmingham Pkwy	375.0	24	4.061
106	18	Brighton	Soldiers Field Road	1.2	8	0.451
107	17	Brighton	1,050 ft S.E. of Arsenal Street	3.5	12	1.015
108	3	Brighton	Western Ave & Marleet Street	30.6	18	2.284
109	12	Brighton	Western Ave. & Litchfield St.	7.1	12	1.015
110	4	Brighton	Western Ave. 170 ft W. of Everett St.	1.8	24	4.061

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
111	13	Brighton	Western Ave. 160' W. of Everett St.	220.0	30	6.345
112	16	Brighton	Spurr St. & No. Harvard St.	1.2	12	1.015
113	10	Brighton	Spurr St. & No. Harvard St.	23.6	15	1.586
114	8	Brighton	Rena & Bertram Streets	5.9	15	1.586
115	2	Brighton	Rena Street	42.5	12	1.015
116	1	Brighton	Seattle & Cambridge Streets	29.5	15	1.586
117	5	Brighton	1200' S. of Cambridge St.	318.0	24	4.061
118	114	Brighton	580' N.W. of Essex Street	13.0	12	1.015
119	3	Roxbury	Comm. Ave. & St. Marys St.	28.3	18	2.284
120	17	Roxbury	Beacon & St. Marys Streets	85.5	18	2.284

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
121	-	Roxbury	Riverway N. of Brookline Ave.	141.5	12	1.015
122	4	Roxbury	Vila St.	39.5	24	4.061
123	9	Roxbury	Fenway opp. Worthington St.	17.7	18	2.284
124	13	Roxbury	Fenway opp. Ave. Louis Pasteur	14.2	12	1.015
125	16	Roxbury	Tremont St. Ent. to Fens @ Ruggles St.	4.1	12	1.015
126	7	Roxbury	Huntington Ave., 40' E. of Bryant St.	38.3	24	4.061
127	14	Roxbury	Huntington Ave., 17' E. of Bryant St.	3.0	18	2.284
128	11	Roxbury	Huntington Avenue near Rogers Ave.	3.0	12	1.015
129	12	Roxbury	Huntington Ave. near Rogers Ave.	7.7	12	1.015
130	8	Roxbury	Huntington Ave. 10' E. of W. Side of Bryant Street.	0.5	12	1.015

TABLE 25. BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(Continued)

Public Connections

CDM Connection No.	MDC Connection No.	District	Location	Net Tributary Sewered Area (acres)	Size (in.)	Rated Capacity (mgd)
131	6	Roxbury	Huntington Ave. 130 ft E. of Parker St.	2.4	12	1.015
132	10	Roxbury	Huntington Ave. 30 ft W. of E. line of Parker Street	9.4	15	1.586
133	5	Roxbury	Huntington Ave & Parker Street.	139.0	15	1.586
134	15	Roxbury	Huntington Ave. & Museum Road	1.2	10	0.704
135	8	Dorchester	River Street at Hyde Park -W.R. line	569.6	54x56 modified circle	21.526
136	-	Boston Main Drainage	Camden Street - Stony Brook Interceptor	269.0	54x48 rectangle	23.271
137	-	Boston Main Drainage	Camden Street - West Side Interceptor	810.0	72x60 rectangle	38.784
138	-	Boston Main Drainage	Columbia Road - South Boston	226.0	36x54 Egg	13.370
139	-	Boston Main Drainage	Mt. Vernon Street - Columbus Park Connection	5,945.6	126	111.890
			Totals	16,852.9		456.580

TABLE 25 BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM

SPECIAL CONNECTIONS

CDM Connection No.	MDC Connection No.	District	Location	Size (in.)[3]	Rated Capacity (mgd).[2]
S-1	Sp.-1	Deer Island	Doctor's House	6	0.253
S-2	Sp.-1	East Boston	36 New St.	8	0.451
S-3	Sp.-2	East Boston	300 Border St.	10	0.704
S-4	Sp.-3	East Boston	Maverick Mills Addition, Saratoga St.	6	0.253
S-5	Sp.-4	East Boston	New St., Bldg. No.3	6	0.253
S-6	Sp.-5	East Boston	New St., Bldg. No.10	6	0.253
S-7	Sp.-6	East Boston	Maverick & Border Sts., Boston Housing Auth.	12	1.015
S-8	Sp.-7	East Boston	MBTA Shop, Faxon St.	6	0.253
S-9	Sp.-8	East Boston	Orient Heights Station, Barnes Ave.	8	0.451
S-10	Sp.-9	East Boston	Maverick St., Nat. Guard Bldg.	8	0.451
S-11	Sp.-6	Charlestown	Alford St., 190' S. of Dexter	12	1.015
S-12	Sp.-10	Charlestown	71 Alford St.	6	0.253
S-13	Sp.-11	Charlestown	Chelsea St., 140' W. of Medford	12	1.015

NOTE: Locations of Special Connections in general are as furnished by MDC.

TABLE 25 BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(continued)

SPECIAL CONNECTIONS

CDM Connection No.	MDC Connection No.	District	Location	Size[3] (in.)	Rated[2] Capacity (mgd)
S-14	Sp.-12	Charlestown	Opp. 494 Rutherford Ave., H.P. Hood	15	1.586
S-15	Sp.-14	Charlestown	Alford St., Boston Edison	10	0.704
S-16	Sp.-15	Charlestown	Rutherford Ave., H.P. Hood	15	1.586
S-17	Sp.-17	Charlestown	Water St., Opp. Chambers St.	6	0.253
S-18	Sp.-18	Charlestown	75 Water St.	10	0.704
S-19	Sp.-19	Charlestown	500 Rutherford St., Hood Plant	12	1.015
S-20	Sp.-20	Charlestown	175 Alford St.	8	0.451
S-21	Sp.-1	West Roxbury	Parental School	12	1.015
S-22	Sp.-2	West Roxbury	Land of Lutheran Evangelical Church near Baker St.	8	0.451
S-23	Sp.-3	West Roxbury	Harding Rd.	6	0.253
S-24	Sp.-4	West Roxbury	Harding Rd.	6	0.253
S-25	Sp.-5	West Roxbury	Harding Rd.	6	0.253

TABLE 25 BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(continued)

SPECIAL CONNECTIONS

CDM Connection No.	MDC Connection No.	District	Location	Size(3) (in.)	Rated(2) Capacity (mgd)
S-26	Sp.-6	West Roxbury	10 Hadwin Way	6	0.253
S-27	Sp.-9	West Roxbury	St. Joseph's Cem., 240' E. of Baker St.	6	0.253
S-28	Sp.-10	West Roxbury	Caledonia Grove	6	0.253
S-29	Sp.-11	West Roxbury	St. Joseph's Cem., between Baker & La Grange Sts.	6	0.253
S-30	Sp.-12	West Roxbury	Harrison St., Extended	6	0.253
S-31	Sp.-13	West Roxbury	Harrison St., Whittemore Co.	6	0.253
S-32	Sp.-14	West Roxbury	La Grange St., 80' N.W. of Brook Farm Road	6	0.253
S-33	Sp.-15	West Roxbury	V.F.W. Pkwy 1000' N. of Spring St.	6	0.253
S-34	Sp.-16	West Roxbury	37 Caledonian Ave.	6	0.253
S-35	Sp.-17	West Roxbury	310 Corey St.	6	0.253
S-36	Sp.-19	West Roxbury	1465 V.F.W. Pkwy Esso Service Sta.	6	0.253
S-37	Sp.-21	West Roxbury	750 V.F.W. Pkwy	6	0.253
S-38	Sp.-22	West Roxbury	736 V.F.W. Pkwy	6	0.253

TABLE 25 BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(continued)

SPECIAL CONNECTIONS

CDM Connection No.	MDC Connection No.	District	Location	Size[3] (in.)	Rated[2] Capacity (mgd)
S-39	Sp.-23	West Roxbury	724 V.F.W. Pkwy	6	0.253
S-40	Sp.-24	West Roxbury	722 V.F.W. Pkwy	6	0.253
S-41	Sp.-25	West Roxbury	754 V.F.W. Pkwy	6	0.253
S-42	Sp.-26	West Roxbury	740-742 V.F.W. Pkwy	6	0.253
S-43	Sp.-27	West Roxbury	95 Brook Farm Rd.	6	0.253
S-44	Sp.-28	West Roxbury	1457 V.F.W. Pkwy	6	0.253
S-45	Sp.-33	West Roxbury	V.F.W. Pkwy opp. #1515	6	0.253
S-46	Sp.-1	Hyde Park	Station St., 100' S. of Fairmount Ave.	8	0.451
S-47	Sp.-2	Hyde Park	Station St., 20' N. of Fairmount Ave.	6	0.253
S-48	Sp.-3	Hyde Park	River St., near Mattapan Mills	6	0.253
S-49	Sp.-4	Hyde Park	40' E. of junction Fairview Ave. & Charles St.	4	0.113
S-50	Sp.-5	Hyde Park	River St., 200' E. of Reddy Ave.	12	1.015
S-51	Sp.-6	Hyde Park	1625 River St.	6	0.253

TABLE 25 BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(continued)

SPECIAL CONNECTIONS

CDM Connection No.	MDC Connection No.	District	Location	Size(3) (in.)	Rated(2) Capacity (mgd)
S-52	Sp.-7	Hyde Park	110 Business St.	6	0.253
S-53	Sp.-8	Hyde Park	58 Business St.	6	0.253
S-54	Sp.-1	Brighton	Abattoir	15	1.586
S-55	Sp.-2	Brighton	Abattoir	15	1.586
S-56	Sp.-3	Brighton	Tripeworks, 1100' E. of No. Beacon & Parson Sts.	15	1.586
S-57	Sp.-4	Brighton	Western Ave. Playground	8	0.451
S-58	Sp.-5	Brighton	Seattle St., 390' W. of Hopedale St.	6	0.253
S-59	Sp.-7	Brighton	600' W. of Hillside Ave.	6	0.253
S-60	Sp.-8	Brighton	Soldiers Field Rd., 310' S. of St. Paul St., extended	6	0.253
S-61	Sp.-9	Brighton	31 Abattoir Ave., rear	8	0.451
S-62	Sp.-10	Brighton	33 Abattoir Ave., rear	8	0.451
S-63	Sp.-11	Brighton	Concrete Products	6	0.253
S-64	Sp.-12	Brighton	10 Spurr St.	8	0.451

TABLE 25 BOSTON CONNECTIONS TO THE METROPOLITAN SEWERAGE SYSTEM
(continued)

SPECIAL CONNECTIONS

CDM Connection No.	MDC Connection No.	District	Location	Size (3) (in.)	Rated Capacity (2) (mgd)
S-65	Sp.-13	Brighton	84 Seattle St.	6	0.253
S-66	Sp.-14	Brighton	70 Seattle St.	6	0.253
S-67	Sp.-16	Brighton	805 Commonwealth Ave.	4	0.113
S-68	Sp.-17	Brighton	79 Seattle St.	6	0.253
S-69	Sp.-18	Brighton	Pressure regulator chamber, MDC Water	6	0.253
S-70	Sp.-19	Brighton	76 Seattle St.	6	0.253
S-71	Sp.-20	Brighton	S. of Cambridge St.	8	0.451
S-72	Sp.-1	Roxbury	Parks Commission, Adm. Bldg.	6	0.253
S-73	Sp.-2	Roxbury	Back Bay Fens, 133' N. of Brookline Ave.	6	0.253
S-74	Sp.-4	Roxbury	Simmons College	10	0.704
S-75	Sp.-6	Roxbury	Museum of Fine Arts	10	0.704
S-76	Sp.-7	Roxbury	Museum of Fine Arts	8	0.451
S-77	Sp.-8	Roxbury	Tufts Medical School	8	0.451
S-78	Sp.-9	Roxbury	School, City of Boston	8	0.451
S-79	Sp.-10	Roxbury	Museum of Fine Arts, 230 Fenway	8	0.451
			Total		36.170

APPENDIX F

APPENDIX F

THE PROPOSED DEEP TUNNEL PLAN

Introduction

Simply stated, the proposed Deep Tunnel Plan for the Boston Region involves the construction of large tunnels in rock under the city into which all of the overflows can be discharged through vertical shafts. The tunnels will store and conduct the overflows to a point where they can be pumped and disposed of in an acceptable manner. After consideration of possible surface storage at Deer Island with subsequent treatment at the MDC sewage treatment plant, we have concluded that disposal by means of an ocean outfall is preferable. It is essential, as a part of this plan, that the tunnels be emptied as soon as possible following a storm to provide the available storage volume for the next storm.

Shortly after beginning our study of improvements to the Boston Main Drainage System we learned of a proposed deep tunnel storage plan for flood and pollution control prepared for the Metropolitan Sanitary District of Greater Chicago by the firms of Harza Engineering Company and Bauer Engineering, Inc. The report is entitled "Flood and Pollution Control, A Deep Tunnel Plan for the Chicagoland Area" and is dated May, 1966.

After a thorough review of the Chicago plan, including discussions with the engineers involved, we concluded that the basic concept of deep rock tunnels for storing overflows is most attractive and appears to offer possibilities that other methods do not.

The geologic formation of the City of Boston, discussed in Chapter II, lends itself to such a deep rock tunnel concept. The Metropolitan District Commission has recently constructed smaller size deep rock tunnels as part of the metropolitan sewerage and water systems. In addition, extensive records on the rock beneath Boston are available as a result of innumerable construction projects and borings which have been undertaken in the city. Thus, we were able to obtain rock profiles as well as rock compositions to a degree normally not available in a preliminary engineering investigation.

The Problem

At the present time, there are about 1360 miles of sewers in the City of Boston, many of which were built over 100 years ago. Most of these sewers, particularly in the older sections of the city, are combined, and their condition is questionable.

Between 1877 and 1884, the City of Boston engaged in its most recent major sewer improvement project which consisted of the construction of about 25 miles of main and intercepting sewers, a pumping station at Calf Pasture, and an outfall sewer and holding tanks on Moon Island. This constituted construction of what is known as the Boston Main Drainage System and was a most far-sighted and progressive attempt to take are of sanitary conditions existing at that time. Much of this system is overloaded and several sections have collapsed.

There are many outlets into Boston Harbor and adjacent waters, including the Charles River, Mystic River and Neponset River. It is estimated at the present time that there are about 90 outlets in Boston which discharge dry weather flows of sewage continuously or mixed sewage and storm water during wet weather. Most of these outlets are old and do not function effectively. Of the approximately 20,500 acres of total sewered area in the City of Boston, it is estimated that about 7,000 acres are served directly by combined sewers and about 10,100 additional acres are now served directly by separated systems which discharge to combined sewer outlets.

The discharge of untreated dry weather flows of sewage and of untreated discharges of mixed sewage and storm water has for many years created nuisance conditions in and around Boston. Objectionable odors, grease balls and sewage sludge deposits resulting from such discharges may be found in the vicinity of several of the most popular recreation areas in Boston. The presence of bacteria and viruses associated with the discharge of untreated flows has for many years constituted a significant health hazard to persons using the waters of Boston Harbor and its estuaries. As part of our investigation, we conducted a sampling program to determine the effect of overflows on the bacterial quality of waters in beach areas around the city and Charles River Basin. The results of this program support previous studies and show that gross pollution of these areas does occur. Such a hazard should no longer be tolerated by the citizens of Boston and neighboring communities.

Recent federal and state legislation has resulted in the classification of coastal and inland waters in the vicinity of the City of Boston as well as the rest of Massachusetts. This classification adopted by the State on June 20, 1967 and approved by the Federal government means that the continued discharge of untreated mixed sewage and storm water is a violation. It is thus most important that the City of Boston have a feasible plan to follow in its efforts to improve its sewerage system and to dispose properly of its mixed sewage and storm water discharges.

Alternative Methods to Handle Mixed Sewage and Storm Water Flows

A number of communities neighboring Boston also have combined sewer systems which now discharge through outlets into Boston Harbor and adjacent waters. The principal communities having such systems are Brookline, Cambridge, Chelsea and Somerville. Methods for handling discharges of sewage or mixed sewage and storm water from combined systems should, in our opinion, include the applicable areas in each of these communities. The tributary area in all five communities is referred to collectively as the regional area.

To determine the most feasible method of handling mixed sewage and storm water discharges to Boston Harbor and adjacent waters, we have investigated a number of alternative methods. Until the most feasible method was determined, the proper location and design of required improvements to principal existing intercepting sewers could not be accomplished. In Chapter VII is presented a complete description

together with estimated costs for each principal alternative method studied. A comparison of costs of alternative methods is presented hereinafter. The alternative methods in addition to the Deep Tunnel Plan are complete separation, construction of chlorination detention tanks and construction of holding tanks.

Complete Separation

The most positive method of separating storm water and sewage flows is to provide completely separate sanitary sewerage and storm drainage systems. Separation has been the policy of the City of Boston for 60 years. Separation, if completely accomplished, would eliminate all discharges of overflows of mixed sewage and storm water. In Boston and neighboring municipalities where systems are now combined, this would require the construction of a new sanitary sewer in every street where a combined sewer now exists. It would also involve new separate plumbing connections to all of the existing buildings, and the re-plumbing of many entire buildings to separate roof drainage from the sanitary sewerage system. In many areas, yard drainage which now discharges into the combined system would also have to be repiped to the separate storm water systems. The construction of new separate sanitary sewers in the combined areas of the city would require the digging-up of every street and result in enormous traffic problems that would interfere with every day activities. New sanitary sewers would be required to serve 7,000 acres in Boston, and an additional 5,000 acres in the regional area.

It is not considered feasible or practical to completely separate existing building plumbing into separate sanitary and storm systems. The great problem of enforcement of such separation in private dwellings by owners would have to be carried out under city ordinance by teams of inspectors. The only other possible way to affect separation of building plumbing would be for the city to go into each building and accomplish the separation itself. Separation in many buildings would require extensive renovations to the buildings themselves.

Construction of Chlorination Detention Tanks

A second alternative method for handling mixed sewage and storm water discharges involves construction in the vicinity of selected outlets of chlorination detention tanks, which would collect, detain and adequately chlorinate discharges or overflows of dry weather flow or mixed sewage and storm water before discharging to nearby water-courses. This would remove bacteria and viruses but would not affect the discharge of putrescible organic matter. As stated heretofore, there are about 90 outlets into Boston Harbor and adjacent waters from the combined systems in Boston alone. There is probably an equal number of such outlets in neighboring communities. About 30 tanks would be required to serve outlets in Boston alone. Near each outlet or combination of outlets must be available sufficient land area for construction of such tanks in order to make this method feasible. The total land area required to serve the number and location of outlets in the city exceeds the land area which could readily be made available for such holding tank construction. We estimate that these tanks, with depths of 12 feet would require a total land area of about 100 acres to serve 10,300 acres in Boston and about 160 acres to serve 17,000 acres in the regional area consisting of Boston, Brookline, Cambridge, Chelsea and Somerville. The cost of taking land for this method even if it

were to be made available would be high. The land could not then be used for recreational, business or residential purposes.

The enormous problem connected with the operation and maintenance of pumping, chlorination and cleaning facilities in such a system of mixed sewage and storm water chlorination detention stations together with land requirements precludes any further consideration of this method.

Construction of Holding Tanks

A third alternative method of handling mixed sewage and storm water discharges involves construction of holding tanks in the vicinity of selected outlets, which would store the discharges or overflows until the storm subsides. The stored flows could then be released back into the dry weather interceptor system for disposal with the normal sewage flow in the MDC sewerage system. Because almost the entire runoff volume for the 15 year design storm would have to be stored, the holding tanks would be much larger than chlorination detention tanks and more land area would be required.

We estimate that about 30 holding tanks would be required for the approximately 90 outlets serving about 10,300 acres now tributary to combined sewer outlets in Boston alone. With depths of 10 feet (in order to eliminate pumping) these tanks would require a total land area of about 640 acres, one square mile. About 1,060 acres of land would be required to serve the 17,000 acre regional area.

Under this method flows in excess of the 15 year design storm flow would overflow untreated to nearby watercourses. Provision of chlorination facilities would increase the cost of this method, and in effect we would then have a series of very large chlorination detention tanks.

Since more land area would be required for holding tanks than for chlorination detention tanks, the disadvantages of holding tanks due to land requirements in Boston are correspondingly greater than for chlorination detention tanks. In addition, the problem of sludge handling would have to be considered.

Based on the above considerations, the construction of holding tanks does not appear feasible or practical as a solution to the mixed sewage and storm water overflow problem in the Boston region.

Other Methods of Handling Mixed Sewage and Storm Water Overflows

The three methods of solving the problem of combined sewers discussed above are those which have been most commonly applied to date. However, none of these methods of handling mixed sewage and storm water overflows appears adaptable to all cities and towns. In addition, none of the aforementioned methods is very attractive for operation, maintenance and cost reasons.

The Federal Government has recognized this situation and during 1965 enacted legislation that provides for Federal Water Pollution Control Administration research and demonstration grants in an effort to develop new methods. This legislation has indeed stimulated research and a number of municipalites throughout the U.S. have received such grants to study among other possibilities, holding and treatment lagoons, more efficient control of flow volume from combined sewers into interceptors, the feasibility of digging wells to lower ground water tables and reduce infiltration, the investigation of storing overflows in deep rock storage tunnels, and a study being conducted by the American Society of Civil Engineers on the feasibility of pumping sanitary sewage from buildings through small diameter pressure lines installed in existing building connections and combined sewers. The above gives an indication of the range of research being done on this problem.

Of the various alternative methods possible, only the method of storing overflows in deep rock storage tunnels, in our opinion, provides the Boston region with a realistic and feasible method of solving the problem of combined sewers. The following preliminary engineering report on the proposed Deep Tunnel Plan indicates its feasibility and the desirability of further study of the details of this method.

Proposed Deep Tunnel Plan Area to be Served

There exist many outlets for the discharge of mixed sewage and storm water into the Charles River, Mystic River, Neponset River and Boston Harbor from the cities of Boston, Brookline, Cambridge, Chelsea and Somerville. Unless all discharges containing sewage are prevented, the basic problem of eliminating pollution from Boston Harbor and adjacent waters will not be solved. A joint effort by Boston, Brookline, Cambridge, Chelsea and Somerville appears essential.

As mentioned before, there are some 7,000 acres of land in Boston now served directly by the combined sewerage system. In addition, another 10,100 acres are now served directly by separate sewers and discharge through the combined sewers to outlets. Of these approximately 10,100 acres, we propose to divert the storm flow (not mixed with sewage) from about 6,800 acres directly to watercourses. The remaining area of about 3,300 acres of presently separated area in Boston will continue to contribute storm as well as sewage flow to the outlets because it does not appear practical to conduct the separate storm flows elsewhere. Therefore, it is considered that a total area of about 10,300 acres in Boston will discharge mixed sewage and storm water to the proposed deep tunnel system.

We propose that the Deep Tunnel Plan be of sufficient size and capacity and suitably located to serve the tributary areas of Boston and four neighboring communities with combined sewer systems, thus solving on a regional basis, the problem of water pollution abatement. We estimate that there are now about 6,700 additional acres tributary to combined sewer outlets in Brookline, Cambridge, Chelsea and Somerville. Therefore, the total area to be served by the proposed Deep Tunnel Plan is proposed to be about 17,000 acres. The proposed Deep Tunnel Plan would eliminate all overflows of mixed sewage and storm water from this entire area.

Rainfall. In design considerations of a tunnel storage plan, the volume and intensity of rainfall are very important factors. In our consideration of the proposed Deep Tunnel Plan, two significant rainstorms have been used; (1) a 5-in storm in 24 hours, with a frequency of recurrence of about 15 years, which can be handled without surcharging the tunnels with the pumping capacity provided and (2) an 8.40 in storm in 24 hours with surcharging of the tunnels. The total rainfall depth shown on Fig. F-1 "Depth of Rainfall vs. Frequency for Boston, Massachusetts", for a storm of one day duration and 100 year frequency is about 7.0 inches. The maximum recorded 24 hour rainfall in Boston is 8.40 inches and the maximum recorded 24 hour rainfall in Massachusetts is 18.15 inches, both of which occurred in August 1955 (Hurricane Diane).

Whereas it is obvious that a tunnel system designed on the basis of 5.00-in and 8.40-in storms in 24 hours will not be adequate for a 24-hour rainfall in excess of 8.40 inches, such excessive rainfalls must nevertheless be expected. The capacity of the present sewerage system is such, however, that is unable to deliver enough flow to exceed the proposed tunnel system design capacity of 8.40-in in 24 hours, and the excess flow must, therefore, be stored at the surface or run off overland to the nearest watercourse. Even when replacements are made to the surface collection system to increase its capacity, it is expected that its total capacity to deliver flows to the tunnel system will not exceed the runoff from an 8.40-in storm. Nevertheless, pumps will have adequate capacity to pump flows from such excessive storms through a short outfall.

Based on the set of curves shown on Fig. F-1, it appears that the total volume of rainfall in one day expected for a storm frequency of about once in 15 years is about 5-in over the entire tributary area. From the curves it is apparent that a depth of 5-in would be expected from a storm of 48 hours duration about once in 4-1/2 years, and from a 4 day duration storm once in 3 years. Four inches would be expected from a one day storm about once in 5 years. The curves in Fig. F-1 have been developed from data in United States Weather Bureau Technical Papers No. 40 and 49 for recurrence intervals from 2 to 100 years. Data for recurrence intervals from 2 months to 2 years is based on our analysis of Boston rainfall records for the 10 year period 1955 through 1964.

As a result of our studies, it appears reasonable that a deep tunnel storage plan can be constructed that would handle the runoff resulting from a 15 year frequency rain storm of 24 hour duration (total rainfall depth 5-in) and dispose of this runoff within a 2 day period without surcharging the tunnels at any time. If the tunnels are permitted to surcharge, the runoff from a storm equal to the maximum which has been experienced in Boston may be handled. Essentially such a deep tunnel plan would eliminate all overflows to Boston Harbor and adjacent waters and practically all flooding of land areas and basements. We have, therefore, selected these conditions as the basis of design.

Rainfall intensities shown on Fig. F-2 "Rainstorm for Proposed Deep Tunnel Plan", are based on a study of actual rainstorms, hypothetical rainfall for a 15 year frequency storm and data from Weather Bureau Technical Paper No. 40. The 15 year design storm hyetograph and hyetographs for four actual rainstorms of comparable intensities and total storm volume are shown on Fig. F-2. The rainfall and runoff intensities of the 15 year design storm of one day duration are indicated on Fig. F-3, "Rainfall

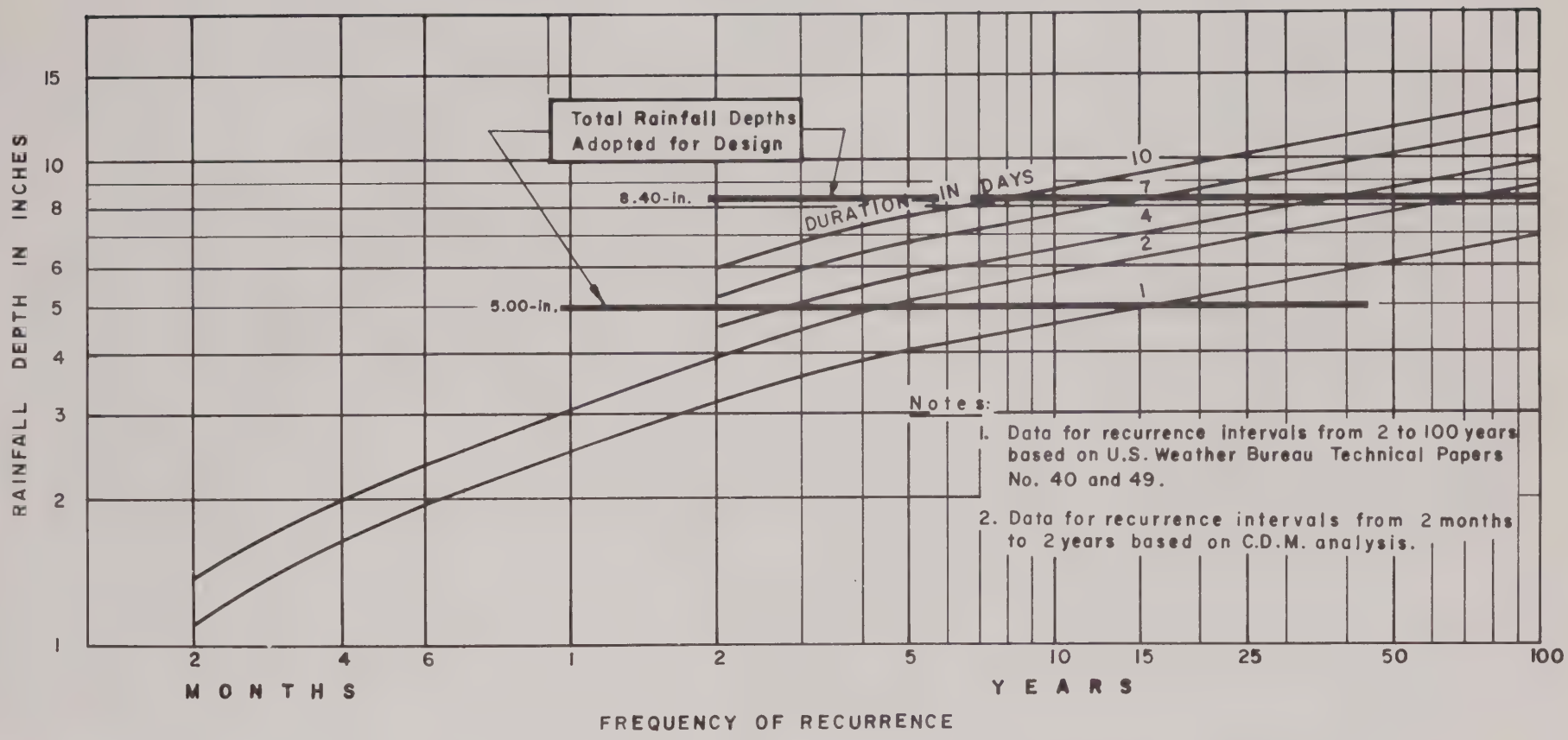
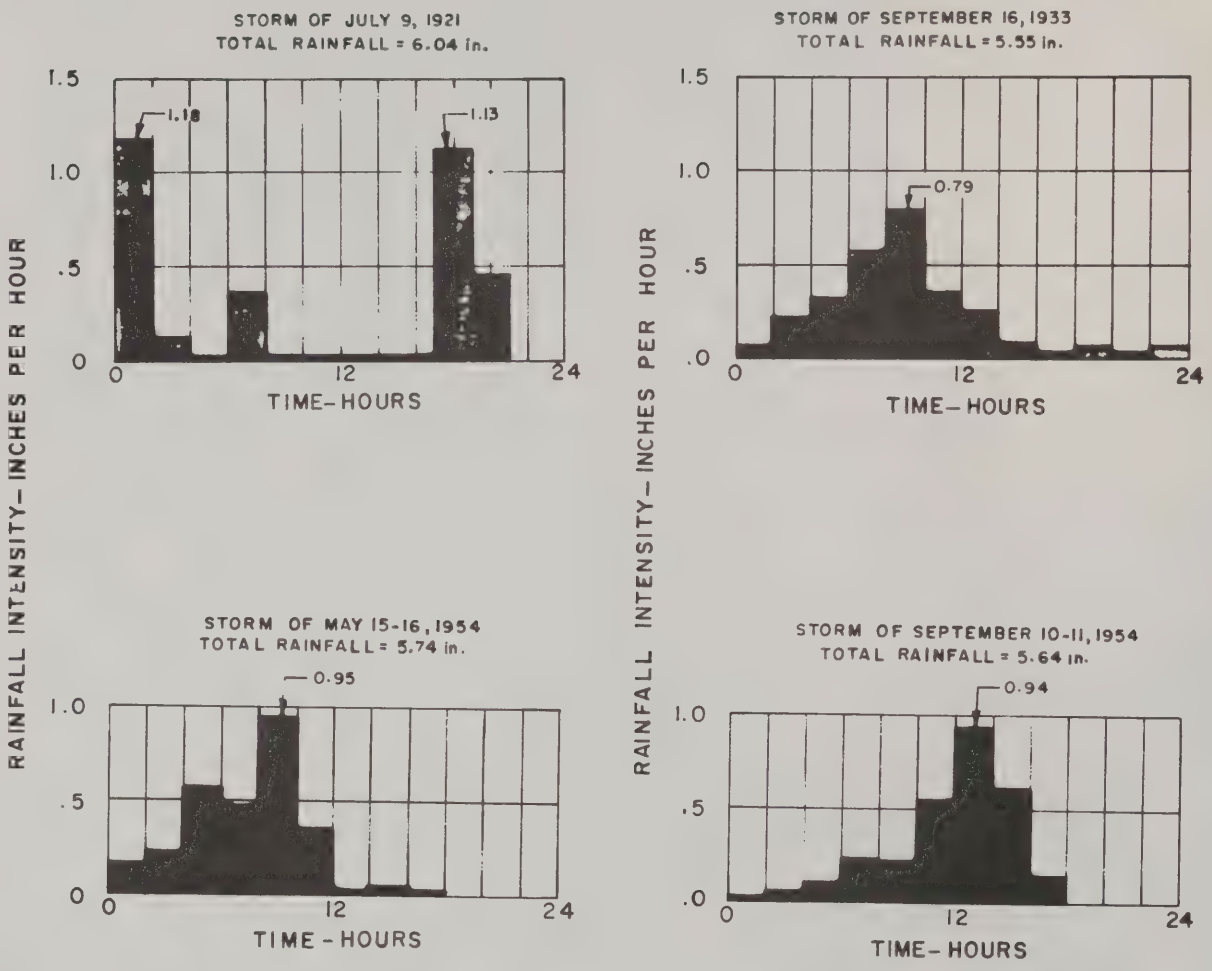
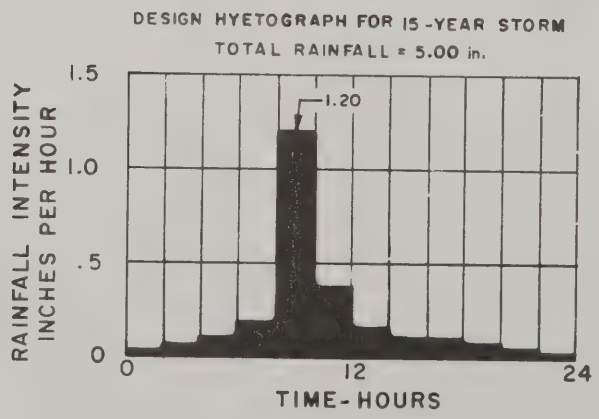


FIG. F-1 DEPTH OF RAINFALL VS FREQUENCY FOR BOSTON, MASSACHUSETTS

Camp, Dresser & McKee
Consulting Engineers
Boston, Mass.





CITY OF BOSTON, MASSACHUSETTS

REPORT ON IMPROVEMENTS TO THE BOSTON MAIN DRAINAGE SYSTEM

RAINSTORMS FOR PROPOSED DEEP TUNNEL PLAN

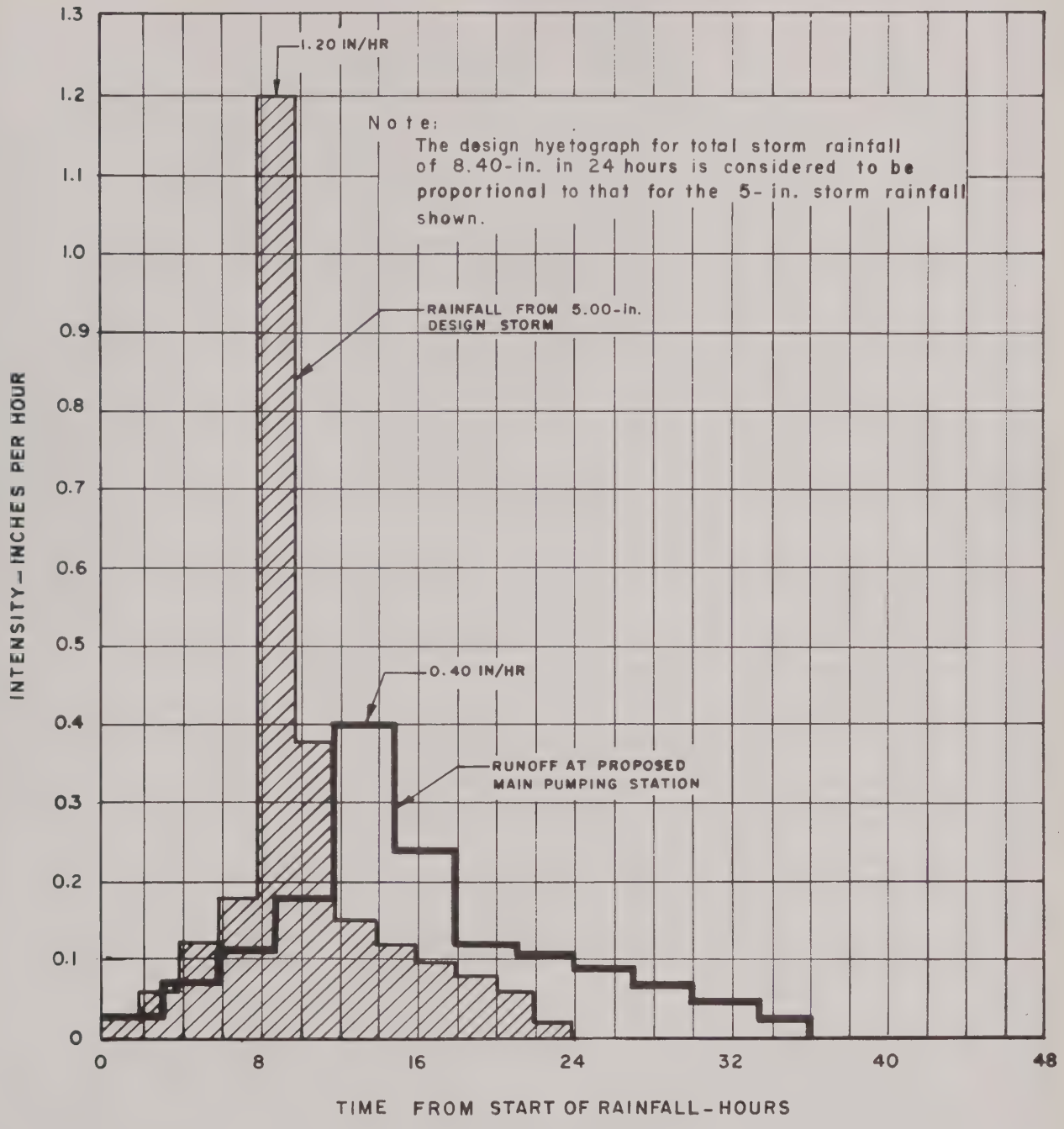
Camp Dresser & McKee
Consulting Engineers
Boston, Mass.

SCALE: AS INDICATED

SEPTEMBER, 1967

FIG. F-2

257-8403



CITY OF BOSTON, MASSACHUSETTS

REPORT ON IMPROVEMENTS TO THE BOSTON MAIN DRAINAGE SYSTEM

RAINFALL AND RUNOFF INTENSITIES FOR PROPOSED DEEP TUNNEL PLAN

Camp, Dresser & McKee
Consulting Engineers
Boston, Mass.

SEPTEMBER, 1967

FIG. F-3

257-8404

and Runoff Intensities for Proposed Deep Tunnel Plan". On Fig. F-3, it is indicated that the peak 2 hour period of the hypothetical 5-in (15 year) storm, with an average intensity of 1.2-in per hour, would fall in the 8th and 9th hours after the start of rainfall. Also shown on Fig. F-3 are estimated inflow rates at the proposed Main Pumping Station at Deer Island resulting from such a storm.

Storage vs. Pumping There appear to be numerous alternative arrangements possible in the development of a deep tunnel plan with relation to the volume of storage and the rate of pumping. These alternatives range from an arrangement of maximum pumping capacity with no effective storage to very large volume of storage and minimum pumping capacity. As discussed hereinafter, the estimated cost of a deep tunnel storage plan is dependent in large measure on the cost to excavate rock. Our estimates have been based on the use of 33 ft diameter storage tunnels similar to those proposed in the Chicago study. During the course of our studies to determine reasonable tunnel capacities, we investigated eight separate arrangements ranging from a pumping rate of 1370 cfs and 35 miles of 33 ft diameter storage tunnels to a pumping capacity of 2410 cfs and 15 miles of 33 ft diameter storage tunnels. It was determined from our studies of relative costs that the cost increase connected with increasing the pumping capacity is far less than the cost of increasing the storage capacity. It was, therefore, decided that a maximum practical length of storage tunnels of 17.2 miles should be provided as discussed hereinafter.

This analysis resulted, after some refinement, in a required minimum pumping capacity of about 2,400 cfs to handle a 5.00-in rainstorm, together with a storage volume equivalent to a length of about 17.2 miles of 33 ft diameter tunnels, if the tunnels are not permitted to surcharge. By permitting the tunnels to surcharge for a rainstorm of 8.40-in. in 24 hours, a pumping capacity of about 5,200 cfs may be obtained using the same pumps as are required for 2,400 cfs without surcharging. Moreover, for rainstorms in excess of 8.40-in. in 24 hours the same pumps could serve if the whole flow were discharged at Deer Island through a short outfall.

At a pump discharge rate of 2,400 cfs, the required total dynamic pumping head will vary from about 305 ft to about 350 ft depending upon the water level in the tunnels and the tide level in the ocean. At a pump discharge rate of 5,200 cfs, the required head, with storage tunnels surcharged, would be about 200 ft.

Fig. F-4, "Deep Tunnel Storage Volume and Pumping Rates", has been developed from the data presented in Fig. F-3. The curve in Fig. F-4 is a mass or cumulative curve of inflow to the proposed Main Pumping Station. It indicates that pumping at a continuous rate of 2,400 cfs starting at about the 5th hour following the start of the 5-in design rainfall will empty the tunnel storage reservoir by the end of the 36th hour. For a pumping rate of about 5,200 cfs the tunnels could be emptied in a shorter period of time.

It is not possible at the present time to consistently predict with accuracy the intensity, duration or volume of rainfall which may occur for a storm. As a result it will not be possible to fully foresee the maximum pumping rate which may be required for a given storm. Therefore, it will probably be necessary to operate the pumps individually, following as closely as possible the storm development. This procedure will tend to minimize the possibility that the storm might develop so rapidly

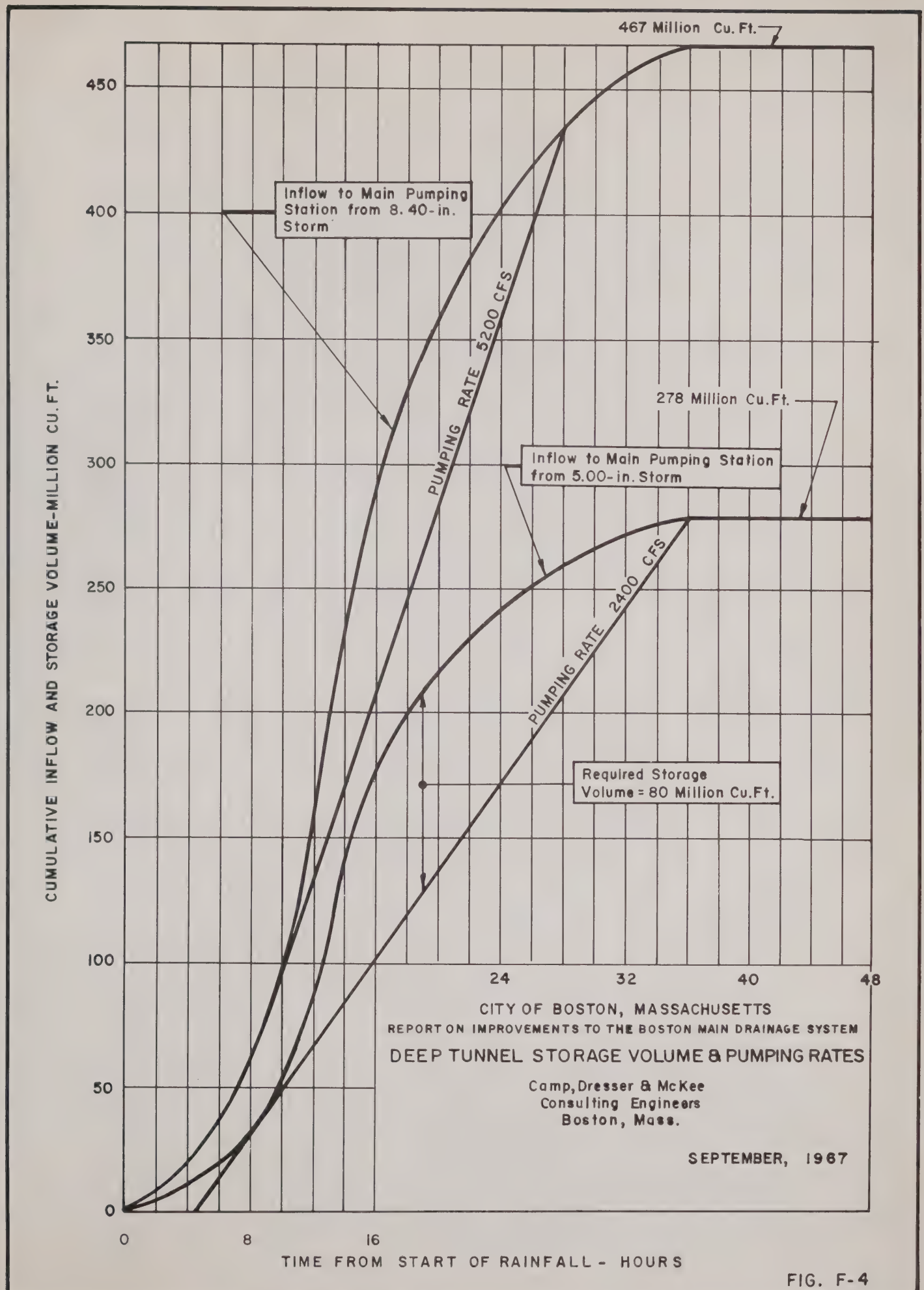

467 Million Cu. Ft.
278 Million Cu.Ft.
Inflow to Main Pumping Station from 8.40-in. Storm
Inflow to Main Pumping Station from 5.00-in. Storm
PUMPING RATE 5200 CFS
PUMPING RATE 2400 CFS
Required Storage Volume = 80 Million Cu.Ft.
CUMULATIVE INFLOW AND STORAGE VOLUME-MILLION CU. FT.
TIME FROM START OF RAINFALL - HOURS
0
50
100
150
200
250
300
350
400
450
0
8
16
24
32
40
48
CITY OF BOSTON, MASSACHUSETTS
REPORT ON IMPROVEMENTS TO THE BOSTON MAIN DRAINAGE SYSTEM
DEEP TUNNEL STORAGE VOLUME & PUMPING RATES
Camp, Dresser & McKee
Consulting Engineers
Boston, Mass.
SEPTEMBER, 1967

FIG. F-4

that the tunnels become filled earlier than anticipated. Obviously as experience in the operation of such facilities and greater accuracy in storm forecasts are achieved, control will become more positive.

It is quite unlikely, at least in the near future, that the tunnels will receive storm flows in excess of the 15 year design storm inasmuch as the tributary sewers are in many cases inadequate in capacity for such flows. As a result, surcharging of the tunnels should not occur until such time as the tributary sewer system is provided with the necessary capacity. Should an excessive storm occur, surface runoff generally may be expected to discharge overland directly to nearby watercourses without entering the sewers.

Ocean Outfall. For the preliminary design of the outfall and diffusers proposed in this report, the analysis of diffusion of the waste water field in the ocean utilized all available data on the subject. Proper disposal of sewage effluent or mixed sewage and storm water to large bodies of water requires an effective mingling of these polluted waters within the water body to prevent the identification of the discharged waste water, prevent odor nuisance, and reduce bacterial concentrations.

A study by W. Torpey was made recently of the decrease in dissolved oxygen levels in New York Harbor and the Thames Estuary resulting from rapid population growth of and sewage discharges from New York City and London, England. The study based on many years of record at each location, indicates that conventional wastewater treatment prior to discharge into harbor or estuarine waters may result in no appreciable improvement in the dissolved oxygen content of such waters. It appears, therefore, that the disposal of all sewage through a long outfall to sea is the most effective means of abating the pollution of Boston Harbor.

To provide positive kill of bacteria and viruses, a chlorine dose of 30 ppm applied to the flow within the outfall pipe is considered adequate and is therefore recommended. With a velocity in the pipe of 7.5 ft per second (pumping rate 2,400 cfs), the proposed outfall would provide over 1-1/2 hours contact time.

In order to meet economically the above requirements for disposal of waste water by means of submarine outfalls, it is necessary to consider the most effective methods of mixing and dispersing in the water body as near to shore as possible while preventing the pollution of beach areas. This problem is concerned with mixing and dilution of the waste water in the immediate proximity of the discharge point, and ultimate disposition of the waste-sea water mass. The mixing and dilution at the discharge point is best accomplished by discharging through a number of orifices located on the sides of the pipe. These orifices are quite small in comparison to the pipe diameter.

During our studies and in conjunction with the design of the proposed Main Pumping Station, we considered seven different pumping rates through a single pipe outfall and a double pipe outfall. Preliminary costs were prepared for each alternative and compared with the corresponding cost estimates for the tunnels and the pumping station.

The most economical combination included a single 20 ft diameter outfall with twin 14 ft diameter diffuser pipes. At pumping rate of 2,400 cfs the velocity in the outfall pipe would be about 7.5 fps, and with 7-in diameter nozzles in the diffuser pipes 15 fps nozzle velocities would be achieved.

Our studies indicate that with a pumping rate of 2,400 cfs, a nozzle discharge of 4 cfs and a water depth of about 110 ft at the diffusers, an estimated dilution ratio of about 200 parts of sea water to 1 part waste water would be achieved in the rising plume of waste water, if the dispersing effect of ocean currents is ignored. The proposed outfall and diffuser locations, indicated on Fig. F-5, "Proposed Deep Tunnel Plan", are approximate only but are expected to obtain this dilution at this depth.

Relative densities and temperatures of the sea water and waste water may cause stratification. Under certain conditions, particularly during periods of low sea water temperatures, the plume may reach the surface. In the event that some material should float to the surface, prevailing winds from the northwest, as shown in the Wind Diagram on Fig. F-5, may be expected to carry it out to sea.

On Fig. F-5, wind direction is indicated toward the center of the diagram. Frequency in a given direction is in proportion to the distance from the center.

Current studies made by the U.S. Coast and Geodetic Survey, however, do indicate that tidal currents exist practically all the time. Further mixing and dilution in travel from the dispersion field would be derived from natural turbulence generaged by moving ocean currents.

The waste water, it should be remembered, is composed of mixed sewage and storm water. Studies of overflows indicate that the proportion of sewage to storm water in such mixtures may vary from almost 100 per cent sewage in early stages of a design storm to about 10 per cent during later periods.

As a result of factors such as ocean currents, distance towards shore and composition of the waste water, we would expect dilution ratios to range from about 200 to 1 to perhaps 6,000 to 1. Comparable reductions in the concentrations of bacteria and viruses and other polluting substances would, as a result, range from about 99.50 per cent to 99.98 per cent even without chlorination. These reductions are to be compared with about 95 per cent removal of organic matter to be expected by conventional "complete" treatment. In other words, the concentration of polluting substances remaining after treatment by this method would be less than 10 per cent of that which can be expected following conventional treatment facilities. In view of these considerations, it is our opinion that when the proposed Deep Tunnel Plan is constructed and placed in operation the existing MDC Deer Island Sewage Treatment Plant may be abandoned.

Natural die-off of bacteria and viruses in ocean water has not been allowed for but should have the beneficial effect of further reducing the concentrations. In order to provide positive kill of bacteria and viruses, we propose that the 30 ppm chlorine dose be applied throughout the year for protection of recreation and shellfish taking.

Experience with the dumping of sewage sludge from barges at the entrance to New York Harbor indicate that the solid materials contained in the sludge settle to the bottom. The effect on the quality of sea water in the immediate area is not marked and beyond the immediate area there is no effect. The depth of water into which this sludge was dumped varied between 75 and 125 feet in an arc located between seven and twelve statute miles from shore. These depths and distances compare with those used in the design of the proposed outfall for Boston, as discussed hereinafter.

Based upon this experience and our own studies, it is our opinion that satisfactory disposal of the mixed sewage and storm water from the Boston area can be accomplished through the proposed outfall.

Alternatives Considered in the Development of the Proposed Deep Tunnel Plan

As mentioned before, many alternatives have been considered in developing the proposed Deep Tunnel Plan. The size and length of tunnels, the depth and length of outfalls, the size and location of chambers and the main pumping station are variable. After much consideration, the radial storage tunnel arrangement shown on Fig. F-5 was adopted in order to most effectively locate the tunnels such that access to them for all parts of the area served by combined sewer outlets would be made.

Another arrangement which was seriously considered prior to adopting the radial tunnel system was to locate the storage tunnels generally around the periphery of the Boston peninsula. However, the radial tunnel arrangement was adopted instead of peripheral tunnels because it lends itself to more efficient construction methods, and to operation and maintenance procedures.

In addition, consideration has been given to such alternatives as location of the Main Pumping Station at Columbus Park, discharge of flows from the proposed Main Pumping Station directly through the existing MDC Deer Island Sewage Treatment Plant and provision of a surface storage reservoir at Deer Island. Each of these alternatives is discussed below.

Pumping Station Location

Two principal sites were considered for the location of the Main Pumping Station. These two sites are at Columbus Park, South Boston, and at Deer Island, and the selection is primarily dependent on the need for gravity discharge to Deer Island. The alternatives to such gravity discharge would require a pumping station at Columbus Park and might be accomplished by two methods.

The first method would be to raise all waste water from the storage tunnels into the existing MDC Columbus Park Headworks utilizing the available capacity of the existing MDC Boston Main Drainage Tunnel, which is designed to operate under surcharged conditions, and utilizing the Deer Island Sewage Treatment Plant to treat all the waste water. An additional tunnel could be constructed from Columbus Park to Deer Island to operate in parallel with the existing tunnel to utilize the maximum hydraulic capacity of the treatment facilities available for storm flows, which is estimated to be about 506 mgd. The total treatment plant hydraulic capacity is about 849 mgd of which approximately 343 mgd is allowed for the estimated 1985 average daily dry weather sewage flow. Required operation of the existing pumping station for this system (assuming a new parallel tunnel were constructed) would be such that only the available storm capacity of the existing MDC Boston Main Drainage Tunnel or about 259 mgd (in excess of estimated 1985 average daily dry weather flow of 179 mgd), could be pumped on the first day of a storm since an estimated 247 mgd of storm flow would reach Deer Island from the MDC North Metropolitan Relief Tunnel and North Metropolitan Sewer under design conditions. The construction of a parallel tunnel to carry the 247 mgd (506-259) would not, therefore, affect the tunnel storage capacity required. Furthermore, it is not, in our opinion, reasonable to provide additional tunnel capacity for storm flows from one area and reduce the capacity available to another area.

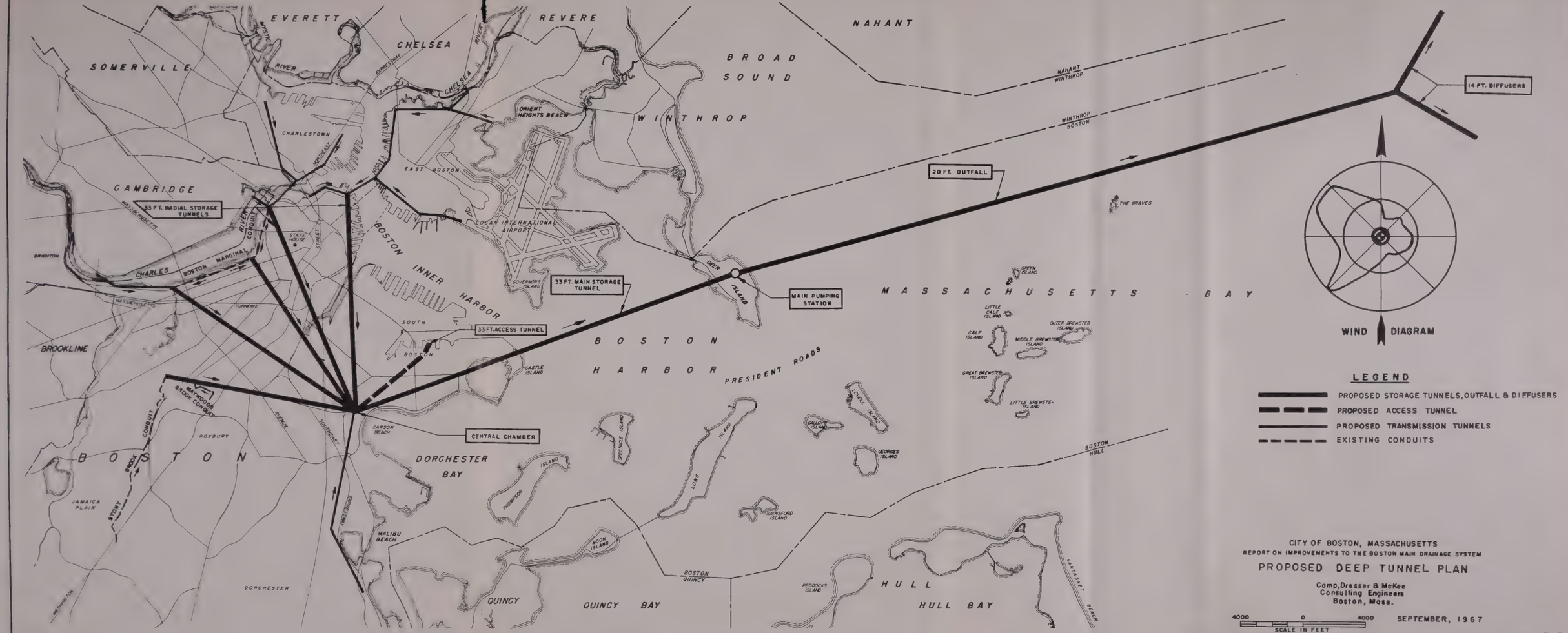

EVERETT
CHELSEA
REVERE
SOMERVILLE
BROAD SOUND
NAHANT
NAHANT WINTHROP
WINTHROP BOSTON
WINTHROP
CHARLESTOWN
ORIENT HEIGHTS BEACH
EAST BOSTON
CAMBRIDGE
33 FT. RADIAL STORAGE TUNNELS
BOSTON MARGINAL CONDUIT
CHARLES RIVER
STATE HOUSE
BRIGHTON
BOSTON INNER HARBOR
LOGAN INTERNATIONAL AIRPORT
GOVERNORS ISLAND
33 FT. MAIN STORAGE TUNNEL
DEER ISLAND
MAIN PUMPING STATION
20 FT. OUTFALL
THE GRAVES
MASSACHUSETTS BAY
GREEN ISLAND
LITTLE CALF ISLAND
CALF ISLAND
OUTER BREWSTER ISLAND
MIDDLE BREWSTER ISLAND
GREAT BREWSTER ISLAND
LITTLE BREWSTER ISLAND
14 FT. DIFFUSERS
WIND DIAGRAM
33 FT. ACCESS TUNNEL
SOUTH BOSTON
BROOKLINE
CASTLE ISLAND
BOSTON HARBOR
PRESIDENT ROADS
MAYWOOD BROOK CONDUIT
CENTRAL CHAMBER
CARSON BEACH
DORCHESTER BAY
ROXBURY
BOSTON
JAMAICA PLAIN
STONY BROOK CONDUIT
SPECTACLE ISLAND
LOVELL ISLAND
LONG ISLAND
GALLOPS ISLAND
GEORGES ISLAND
THOMPSON ISLAND
RAINSFORD ISLAND
BOSTON HULL
MALIBU BEACH
MOON ISLAND
BOSTON QUINCY
QUINCY
QUINCY BAY
PEDDOCKS ISLAND
HULL
HULL BAY
HANCOCK BEACH
DORCHESTER
LEGEND
PROPOSED STORAGE TUNNELS, OUTFALL & DIFFUSERS
PROPOSED ACCESS TUNNEL
PROPOSED TRANSMISSION TUNNELS
EXISTING CONDUITS
CITY OF BOSTON, MASSACHUSETTS
REPORT ON IMPROVEMENTS TO THE BOSTON MAIN DRAINAGE SYSTEM
PROPOSED DEEP TUNNEL PLAN
Camp, Dresser & McKee
Consulting Engineers
Boston, Mass.
4000 0 4000
SCALE IN FEET
SEPTEMBER, 1967

FIG. F-5

Based on the above considerations, the required length of 33 ft diameter storage tunnels to handle runoff from a 5-in rain storm of 1 day duration would be about 52 miles, and about 4.8 days would be required to completely empty the storage tunnels. This method is considered to be too expensive for further consideration.

The second method would be to pump storm flows from Columbus Park directly to Deer Island through a force main. It would not appear reasonable to build a new pumping station limited to the capacity of the existing treatment plant based on the discussion in preceding paragraph because of the volume of tunnel storage required. Therefore, the pumps would have to discharge through a long force main either to a surface storage reservoir or directly to an ocean outfall, and in addition, the force main would remain full when pumps were not operating. There would be no reduction in the required volume of storage tunnels or sizes of the pumping station or outfall and, in fact, an additional 4.5 miles of force main tunnel would be required, if all storage is provided in tunnels. Surface storage at Deer Island is discussed hereinafter. In addition, this method has the distinct disadvantage of a higher pumping cost than pumping at Deer Island and appears to offer no advantages over the proposed arrangement.

We concluded that gravity discharge to a pumping station at Deer Island, as proposed, is desirable for the following reasons:

1. The proposed Main Storage Tunnel to Deer Island will drain when not in use and will provide about twenty five per cent of the storage volume required.

2. Pumping at Deer Island is less costly.

3. A gravity tunnel to and a pump station at Deer Island will provide a natural "back up system" to the existing MDC facilities.

Pump Discharge through the Existing Deer Island Treatment Plant

As described previously, a discharge rate at the proposed Main Pumping Station on Deer Island of about 2,400 cfs (or 1,550 mgd) will be required to handle the runoff from a 5-in storm of 1 day duration. The hydraulic capacity of the existing MDC Deer Island Sewage Treatment Plant available for flows in excess of design dry weather sewage flow is about 506 mgd. With estimated 1985 average dry weather flow (343 mgd) entering the plant at the same time, the total flow entering the treatment facilities would be about 225 per cent of the maximum hydraulic capacity (849 mgd) and about 550 per cent of the treatment plant design capacity (343 mgd). For a storm of 8.40 inches in one day, the existing treatment plant design capacity would be overloaded by over 900 per cent.

In our opinion such overload conditions should not be tolerated. Little or no BOD removal and solids removal at the Deer Island Sewage Treatment Plant could be obtained under these conditions, and all sanitary and storm flows would be discharged at Deer Island untreated except for chlorination.

For storms of lesser intensity and total rainfall volume than the design storm, the adverse effect on the plant would be reduced. Considering the purpose for which the plant was constructed, the increasing sanitary sewage flows to it, and the real advantages of a long ocean outfall such as that proposed herein, we have rejected this scheme.

We have considered a possible means of reducing the magnitude of these overload conditions by providing surface storage at Deer Island as discussed hereinafter.

Surface Storage at Deer Island

We considered the alternative of discharging the storm runoff into a surface storage reservoir at Deer Island and passing it through the existing sewage treatment plant at a controlled rate following a storm.

Using the design criteria discussed earlier, a surface storage reservoir of about 110 acres in area and 30 ft of depth would be required to store about half of the runoff from 17,000 acres during the design storm. The other half would be stored in the deep tunnels. The reservoir could be constructed on Deer Island but would interfere with the land now occupied by the House of Correction and require extensive filling of adjacent shore areas. Construction of the reservoir including the protection of the dikes from sea action, paving of the interior of the reservoir and other heavy construction would cost an estimated 60 million dollars.

Additional disadvantages of the surface storage arrangement are as follows:

1. An ocean outfall would be required for frequent use to dispose of the waste water pumped from the deep tunnels whether or not surface storage is provided.

2. An expenditure of 60 million dollars for a surface storage reservoir is not recommended because the mixed sewage and storm water volume must still, in our opinion, be disposed of within about a 2 day period, either through the plant or through a separate outlet in order to have the reservoir empty before the next storm.

3. The efficiency of the existing sewage treatment plant would be reduced for extended periods following storms.

4. The operation, cleaning and maintenance of the surface reservoir will require large expenditures.

Description of Proposed Deep Tunnel Plan

The proposed Deep Tunnel Plan has been developed for collection and disposal of mixed sewage and storm water flows from 17,000 acres in the Boston region and is shown on Fig. F-5. The plan comprises the following principal elements:

1. Surface connections consisting of interception chambers located on outlet conduits downstream of existing or proposed control chambers which will divert dry weather flows to the existing intercepting sewer system. Excess flows of mixed sewage and storm water flows would discharge to the drop shafts, described below, by surface conduits. Some principal existing surface conduits which may be rehabilitated to serve are shown by means of thin broken lines.

2. Drop shafts, either vertical or inclined, to conduct the flows from the surface connections to transmission tunnels or directly to the deep rock tunnels.

3. Transmission tunnels in rock to carry flows from drop shafts to the storage tunnels. These transmission tunnels are shown as thin solid lines.

4. An underground reservoir consisting of a system of 33 ft diameter deep rock storage tunnels in a radial pattern sloping gently to a central chamber located at Columbus Park, and a 33 ft diameter main storage tunnel extending from the Central Chamber at Columbus Park beneath Boston Harbor to a main pumping station at Deer Island, as shown by heavy black lines on Fig. F-5 . The total length of five radial storage tunnels is about 12.7 miles. The main storage tunnel would be about 4.5 miles in length and would be approximately parallel to and on the south side of the existing MDC Boston Main Drainage Tunnel. The total length of storage tunnels is, therefore, about 17.2 miles.

5. A central chamber located in rock at Columbus Park, with sluice gates, tunnel ventilation and control facilities.

6. A sloping access tunnel shown as a heavy broken line extending from the central chamber at Columbus Park to the vicinity of the Reserved Channel in South Boston. Its purpose is to provide access during construction and for maintenance and inspection purposes.

7. A main pumping station located in a rock chamber at Deer Island with control building, power supply and chlorination facilities, etc., in a surface structure.

8. A 20 ft diameter subaqueous outfall pipe extending about 45,000 ft generally east northeast into Massachusetts Bay terminating in two 14 ft diameter diffuser pipes, each about 5,800 ft long.

As shown on Fig. F-5 , this proposed Deep Tunnel Plan would serve Boston, Brookline, Cambridge, Chelsea and Somerville.

The wind diagrams shown on Fig. F-5 and F-6 indicate that the prevailing wind directions are from the northwest and southwest, generally away from the shore.

Fig. F-6 indicates the outfall and diffusers with relation to existing shore areas in the vicinity. The nearest land area would be Nahant some 5.5 miles from the diffuser pipes. From Marblehead they are some 6.3 miles distant, from the tip of Nantasket Beach some 6.8 miles and from Cohasset some 8.9 miles.

FROM U.S. COAST & GEODETIC SURVEY
CHART 1207 MASSACHUSETTS BAY

FIG. F-6 PROPOSED DEEP TUNNEL PLAN DISPOSAL TO MASSACHUSETTS BAY

1 0 1 2
SCALE IN MILES

Camp, Dresser & McKee
Consulting Engineers
Boston, Mass.

257-8407

Fig. F-7 is an illustrative profile of the proposed Deep Tunnel Plan indicating schematically the transmission tunnels, surface connection conduits, storage tunnels, access tunnel, main pumping station, outfall and diffusers.

Indicated on Fig. F-7 also is the approximate rock surface together with principal surface landmarks. The depth of the storage tunnels is about 300 ft below the surface. The required depth is controlled by the location of the rock surface along its profile. The invert of one radial storage tunnel and the main storage are proposed to be slightly below that of the existing MDC Boston Main Drainage Tunnel to permit dewatering the existing tunnel if required.

A detailed description of the three principle features of the Deep Tunnel Plan (i.e., storage tunnels, main pumping station and ocean outfall and diffusers) is presented below. Estimated construction costs of all items and capitalized annual operation and maintenance costs are shown in Table F-1.

Storage Tunnels

As mentioned above, the storage tunnels consisting of the five radial storage tunnels shown on Fig. F-5 and the main storage tunnel to Deer Island are proposed to be excavated to cross sectional area equivalent to about a 33 ft diameter circle. The design diameter depends on the total required storage volume of the tunnels and the design pumping capacity of the main pumping station at Deer Island.

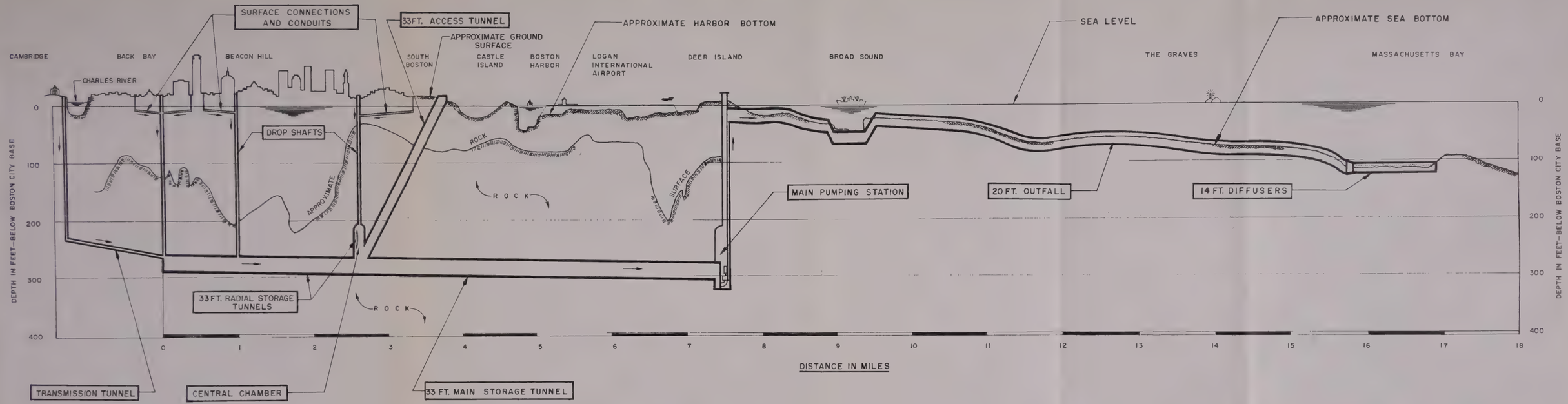
The method of construction of these tunnels at the present time would appear to be by the drill and blast method. We have discussed this project with contractors experienced in tunnel work. The access tunnel sloping at about 8 per cent grade from the ground surface to the central chamber at Columbus Park was proposed as an efficient means for access to the area while the tunnels are being constructed, for easy transportation of the muck to the surface for disposal either as fill in the immediate area or on barges to be disposed of elsewhere. The length of the five radial storage tunnels under Boston is such that the transportation of the muck from the tunnels to the surface poses no unusual tunnel construction. It is our opinion at this time that the sides and top of the tunnels would not have to be lined except where unstable rock is encountered or where rock bolts are needed for stability. In the cost estimate on Table F-1 the cost of the deep storage tunnels includes 25 per cent of the tunnel length full lined, 75 per cent of the tunnel length with paved invert only and 40 per cent of the tunnel length supported by rock bolts. We propose that the bottom of the tunnels be lined with concrete to assist in the operation and maintenance of the tunnel system and also to provide a relatively smooth surface on which the contractors' trucks may operate.

Because the primary function of these tunnels is to provide storage volume and not flow capacity for hydraulic transmission, the shape of the tunnel cross section is not critical, and a horseshoe or other section could be used instead of the circular section if it appears more advantageous and economical.

TABLE F-1

ESTIMATED COST OF THE DEEP TUNNEL PLAN
FOR THE BOSTON REGION

Item	Estimated Cost, million dollars
Deep Storage Tunnels (including Central Chamber and Drop Shafts)	213.0
Main Pumping Station (Deer Island)	39.0
Ocean Outfall and Diffusers	54.0
Surface Connections	26.0
Transmission Tunnels (including drop shafts)	88.0
Separation	10.0
TOTAL ESTIMATED CONSTRUCTION COST	430.0
Capitalized Annual Operation and Maintenance Cost (at 4% interest)	66.0
TOTAL ESTIMATED COST	496.0



CITY OF BOSTON, MASSACHUSETTS

REPORT ON IMPROVEMENTS TO THE BOSTON MAIN DRAINAGE SYSTEM

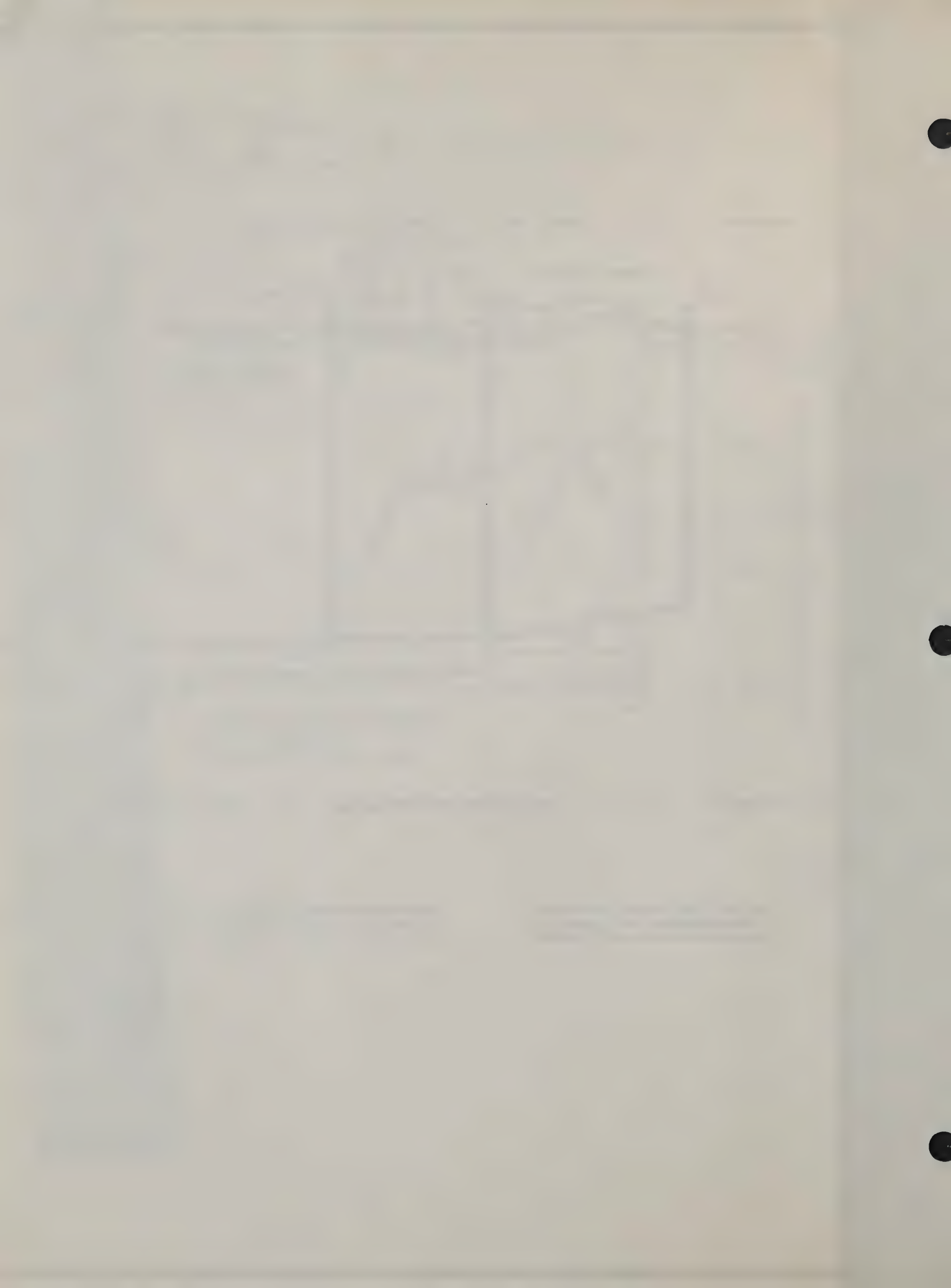
ILLUSTRATIVE PROFILE OF PROPOSED DEEP TUNNEL PLAN

Comp, Dresser & McKee
Consulting Engineers
Boston, Mass.

SCALE: AS INDICATED

SEPTEMBER, 1967

FIG. F-7



Considerable research and experimentation on rock boring machines (moles) with rotary cutting heads in diameters as large as 33 to 36 ft is being done in this country and in Europe. The rock formations, being relatively hard and of varying strength in the Boston area, may not at this time be amenable to successful excavation by the existing types of moles. It appears likely, that in the next five to ten years, the excavation of hard rock by rock boring machines will become routine. If the proposed tunnels can be constructed by such machines, the interior of the tunnels will be of circular cross-section and be quite smooth eliminating in general the need for concrete linings or inverts. Of great significance is the probability that the development of rock boring machines will reduce excavation costs for rock such that the estimated costs of tunnels excavated by boring machines, within a few years, may be substantially less than those of tunnels excavated by drilling and blasting methods. The cost of the rock tunnels contained in this report is based on conventional present-day methods of drilling and blasting with paved inverts throughout and full concrete lining where conditions require it.

We estimate that the construction cost of the 17.2 miles of 33 ft diameter storage tunnels including the necessary shafts, the central chamber and an allowance for tunnel ventilation equipment will be about 213 million dollars as shown in Table F-1.

Main Pumping Station

The location of the Main Pumping Station would be to the east of the existing MDC sewage treatment plant on Deer Island. It would consist of a circular chamber some 180 ft in diameter excavated in solid rock by the drill and blast method.

The station would have design capacities of 2,400 cfs at a total head of about 350 ft with required operating horsepower of about 110,000, and 5,200 cfs at a total head of about 200 feet with a maximum required horsepower of about 150,000 with the tunnels surcharged.

It appears that eight vertical single-stage single-suction pumps will be required. Six of these pumps will be 60-in units, each with a capacity of about 380,000 gpm when driven at a speed of 400 RPM by a 25,000 horsepower, 4,000 volt synchronous motor. Three of these pumps will be provided with magnetic drives to vary their speed. These pumps will be able to handle all design flows reaching the station. The two additional pumps will be 42-in units, each with a capacity of about 90,000 gpm when driven at a speed of 360 RPM by a 9,000 horsepower, 4,000 volt synchronous motor. These two pumps will serve as standby units and will be used to dewater the suction well and tunnels.

The station will be provided with ventilation and control equipment and surge, access and discharge shafts. Provision will be made for screening and hypochlorination facilities. Electric power will be provided to operate the pumps and appurtenant facilities. Estimated power requirements for this station are shown on Fig. F-8 "Power Requirements for Proposed Pumping Station". A horsepower requirement of 150,000 would occur with such rarity that the number of hours this power would be required has not been shown. We have given consideration to the possibilities of generating power at Deer Island and selling power in excess of station demands and of purchasing power from commercial sources. Detailed cost analyses will be necessary to determine the most economical method of providing the necessary power. It has been forecast, however

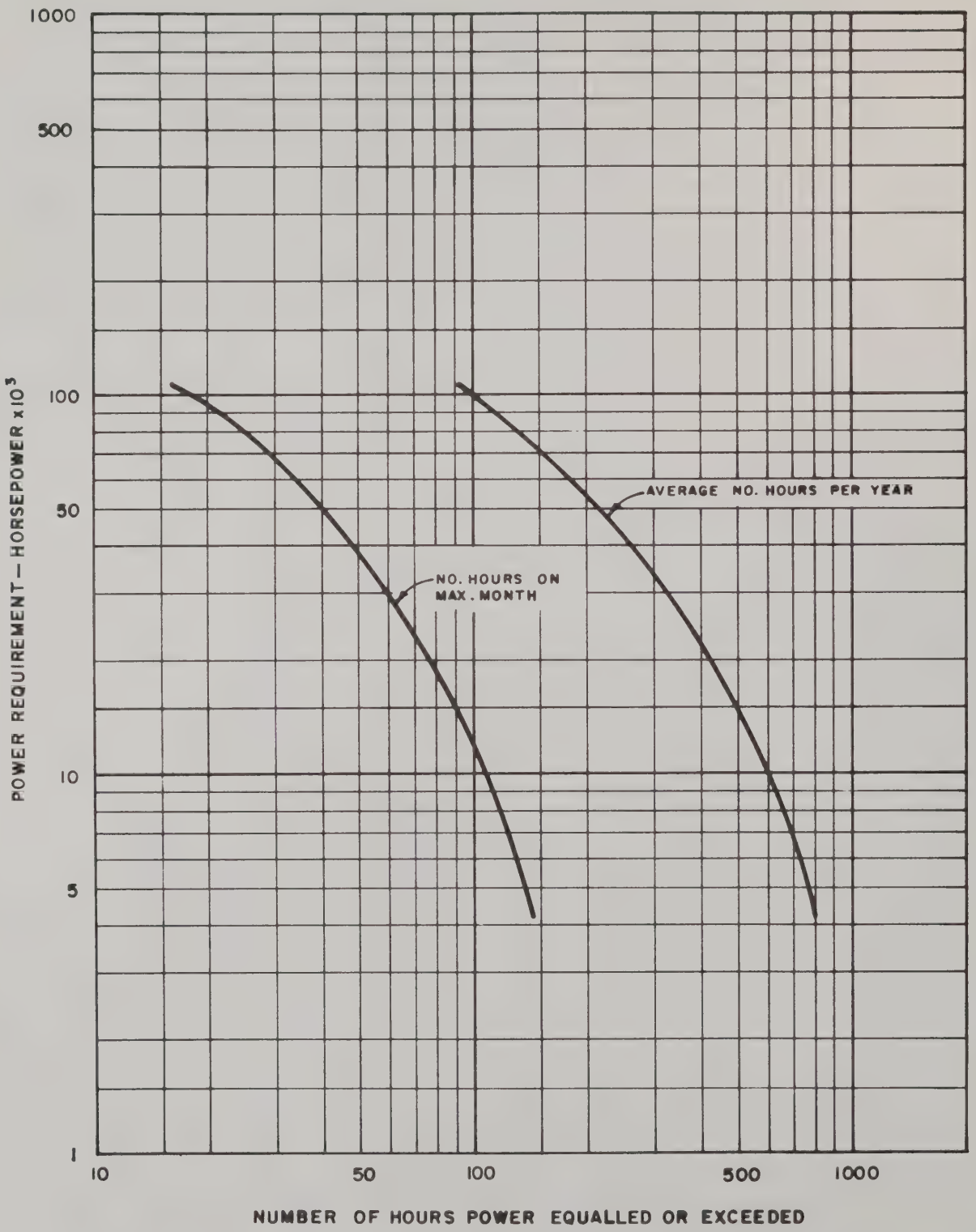


FIG. F-8 POWER REQUIREMENTS FOR PROPOSED MAIN PUMPING STATION

by the National Power Survey that the cost of electricity will be substantially reduced by the year 1980. We estimate the total construction cost of the Main Pumping Station will be about 39 million dollars as shown on Table F-1.

Ocean Outfall and Diffusers

As shown on Fig. F-5 and F-7 the outfall is proposed to extend 45,000 ft generally east northeast into Massachusetts Bay. The pipe will be of reinforced concrete with an internal diameter of 20 ft, and it will be provided with special flexible joints.

The pipe would be laid on the bottom of the bay in a trench sufficiently deep to prevent movement of the pipe. It would be buried where it crosses the main ship channel.

The diffuser pipes would have internal diameters of about 14 ft and be of reinforced concrete with flexible joints. The diameter of the diffuser nozzles will be seven inches with a spacing on each side of the diffuser pipe of about 19.2 ft. The total length of the diffuser pipes would be about 11,600 ft. The diffuser pipes would be located at approximately right angles to prevailing ocean currents in the area. The diffuser pipes will be located at about 110 feet below mean sea level.

The estimated construction cost of the ocean outfall and diffusers is about 54 million dollars as shown in Table F-1.

Advantages of the Proposed Deep Tunnel Plan for the Boston Region

1. The Deep Tunnel Plan provides the best and most practical regional solution to the problem of handling mixed sewage and storm water and assures the abatement of water pollution due to both sewage and surface runoff.

2. The Deep Tunnel Plan is adaptable to serve any conceivable development of Boston or the regional area in the future.

3. The Deep Tunnel Plan is the most economical means for eliminating overflows to the surrounding waters.

4. The estimated total cost of the Deep Tunnel Plan is less than for alternative methods including complete separation, as shown in Table F-2, and this plan may become relatively less expensive in the future as rock boring technology improves.

5. The Deep Tunnel Plan will occupy very little valuable land area.

6. Construction of the Deep Tunnel Plan will not cause interference with traffic or surface activities.

7. Construction of the Deep Tunnel Plan will permit the efficient draining of all areas that now flood during heavy rains and high tides.

8. The Deep Tunnel Plan provides the means for disposing of all polluted surface water and sewage well out to sea away from any inhabited areas. The ocean outfall will permit the safe discharge to sea of all treated or untreated waste water from Deer Island facilities.

9. Sections of the deep storage tunnels will parallel the MDC Boston Main Drainage Tunnel and have lower inverts to complement the existing MDC sewerage system

TABLE F-2

ESTIMATED COSTS OF ALTERNATIVE METHODS FOR THE BOSTON REGION

Method	Estimated Costs, Million Dollars		
	Construction	Capitalized Operation and Maintenance*	Total
Complete Separation	550.0	34.0	584.0
Chlorination Detention Tanks	400.0	133.0	533.0
Holding Tanks	715.0	99.0	814.0
Deep Tunnel Plan	430.0	66.0	496.0

* At interest rate of 4.00%

NOTE: Costs do not include replacement of existing storm drains or combined sewers.

10. The large quantity of rock excavated from the tunnels during construction will be available at low cost for fill in connection with the expansion of Logan International Airport, site development for the proposed 1975 Worlds Fair or other fill operations in and around Boston Harbor.

Implementation of the Proposed Deep Tunnel Plan

In our opinion, it is not reasonable to expect the City of Boston alone to effectively dispose of its mixed sewage and storm water overflows unless neighboring cities and towns having similar combined systems and overflow problems do likewise. For this reason, as mentioned heretofore, the Deep Tunnel Plan should be constructed as a regional operation. It is our opinion that the Metropolitan District Commission or a similar agency be given the power to construct, operate, maintain and administer the system.

It is essential, however, that the City of Boston take the initiative in making this proposed tunnel plan become a reality. The City of Boston is most affected by proposed water quality standards and by the problems connected with its combined system and would, therefore, benefit greatly from the construction of such a proposed Deep Tunnel Plan.

Although the proposed Deep Tunnel Plan is less expensive than complete separation of the system, it nevertheless represents a considerable expenditure. At the present time, State and Federal grants do not appear adequate either in funds or in scope of the existing legislative acts to materially assist in the construction of such a proposed plan.

It is our opinion that other large metropolitan cities located close to the coastline having combined sewerage systems should consider similar deep tunnel plans with disposal to the ocean. A concerted effort by these large cities to join together and obtain substantial financial assistance from the government appears to us the only feasible means for correcting the mixed sewage and storm water overflow problem in the larger and older cities.

We urge the City of Boston take the lead in such a joint effort.

Time required for construction of the proposed Deep Tunnel Plan would be at least five years.

To implement this plan, we recommend that the City initiate efforts for the region to obtain funds available through Federal or State grant programs to defray the cost of the further engineering investigations. Such additional investigations as discussed below will be necessary before final plans can be drawn for such a system.

Further Engineering Investigations Required

Our studies to date have necessarily been preliminary in nature. Detailed engineering investigations for the proposed Deep Tunnel Plan should be required prior to a commitment for final construction plans. Some of the areas which, in our opinion, require more investigation and refinement are as follows:

1. Subsurface explorations - The elevation of the top of rock and the type of rock along the proposed tunnel routes should be ascertained before a final tunnel layout is established.

2. The means and necessity for continuous or intermittent ventilation of the tunnels should be determined.

3. A detailed investigation of the sources and economics of power for the main pumping station at Deer Island should be made.

4. A review and refinement of the relationship between the tributary area, storage, and design storm pumping capacity should be made.

5. The financial and administrative procedures for the construction, operation and maintenance of the system should be determined.

6. Biological studies and more detailed investigations of currents in Massachusetts Bay should be made to assure proper location of the outfall.

7. The possibility of disposing of all storm and sanitary sewage, including all flows now reaching the MDC sewerage system through the proposed outfall should be reviewed in detail.

8. A thorough investigation of the degree of chlorination of mixed sewage and storm water required, should be made.

Recommended Policy on Water Pollution Control for the City of Boston

The present policy of complete separation of sanitary and storm water systems should be continued until a definite commitment to adopt the proposed Deep Tunnel Plan is made.

At that time, the City's sewerage policy can be implemented on the basis that discharges of mixed sewage and storm water will thereafter be effectively handled by the Deep Tunnel Plan.

APPENDIX G

TABLE 20 SUBSURFACE DATA BY OTHERS

CDM Boring No.*	Reference: Boring No.	Reference: Source	Elevation (Boston City Base): From	Elevation (Boston City Base): To	Blows Per Foot	Description
1	11	M.D.C. Connection to Columbus Park Headworks	+20.21	+12.21	22	Medium sand, gravel, boulders, and red brick fill
			+12.21	+ 1.71	1	Very soft silt
			+ 1.71	- 4.29	11	Medium coarse sand and gravel
			- 4.29	- 8.79	14	Stiff yellow clay
			- 8.79	-14.79	5	Medium yellow clay
			-14.79	-24.79	4	Soft yellow clay
			W.L. = +9.04			
6	6	do	+16.97	+10.97	9	Loose sand, gravel, brick, cinders and clay fill
			+10.97	- 0.53	1	Very soft silt and shells
			- 0.53	- 2.03	17	Very stiff yellow clay
			- 2.03	- 5.53	14	Medium gray sand and gravel
			- 5.53	-10.03	8	Medium yellow clay and little fine sand
			-10.03	-25.03	4	Soft yellow clay
			W.L. = +7.80			
35	40	D.P.W. - Roxbury Canal and Dorchester Brook Conduits	+13.9	- 0.1	9	Sand, cinders, silt and rubble fill
			- 0.1	-13.5	3	Sandy peaty organic silt and shells
			-13.5	-28.1	16	Stiff yellow clay
			-28.1	-43.1	6	Medium blue clay
			W.L. = +5.0			
48	1	do	+ 1.0	- 8.0	2	Sandy organic river silt
			- 8.0	-15.0	23	Stiff yellow clay
			-15.0	-30.0	7	Medium blue clay
			-30.0	-37.0	7	Sandy blue clay
			-37.0	-49.0	5	Medium blue clay
			-49.0	-52.0	28	Fine sand and little coarse gravel
			-52.0	-60.5	50	Fine to medium sand, little clay and some medium gravel

*CDM Boring Nos. 2,3,4 and 5 do not exist.

TABLE 20 SUBSURFACE DATA BY OTHERS
(Continued)

CDM Boring No.	Reference		Elevation (Boston City Base)		Blows Per	
	Boring No.	Source	From	To	Foot	Description
56	6	D.P.W. - Roxbury Canal and Dorchester Brook Conduits	+ 2.5	- 5.5	15	Sand, silt and gravel fill
			- 5.5	-11.0	2	Sandy organic silt
			-11.0	-14.5	12	Stiff yellow clay
			-14.5	-27.0	8	Sandy medium yellow clay
			-27.0	-36.5	5	Medium blue clay
61	11	do	+15.0	+ 7.7	9	Sand, cinders, glass, and boulders - Fill
			+ 7.7	+ 1.0	16	Brick, gravel, sand, and clay fill
			+ 1.0	-14.0	9	Fine sand, gravel, and clay fill
			-14.0	-21.0	19	Sandy organic silt, and shells
			-21.0	-24.0	27	Stiff yellow and blue clay
			-24.0	-35.0	6	Medium blue clay
66	16	do	0.0	- 5.0	0	Organic river silt
			- 5.0	-10.0	16	Medium sand and some medium coarse gravel fil
			-10.0	-12.0	10	Sand and gravel fill
			-12.0	-24.0	3	Organic silt
			-24.0	-36.0	3	Soft blue clay
71	27A	do	+ 3.2	- 6.8	0	Organic river silt
			- 6.8	-14.8	2	Organic silt and shells
			-14.8	-23.3	2	Soft silty peat
			-23.3	-26.8	21	Stiff blue and yellow clay
			-26.8	-34.8	22	Very stiff yellow clay
79	153	B.S.C.E. Boring Data from Greater Boston	0	-10		Water
			-10	-13		Black silt, little sand
			-13	-21		Peat
			-21	-29		Stiff clay
			-29	-54		Medium stiff blue clay
			-54	-63		Hard blue clay, little sand, little gravel

TABLE 20 SUBSURFACE DATA BY OTHERS
(Continued)

CDM Boring No.	Reference: Boring No.	Reference: Source	Elevation (Boston City Base): From	Elevation (Boston City Base): To	Blows Per Foot	Description
81		B.S.C.E. Boring Data from Greater Boston	0	-11		Water
			-11	-17.5		Black silt
			-17.5	-28		Silt, little sand
			-28	-40		Medium stiff blue clay
			-40	-51.5		Hard clay, little sand, little gravel
			-51.5	-53		Indurated clay
85	167	do	0	- 8		Water
			- 8	-10		Black silt, little gravel
			-10	-15		Silt, little sand
			-15	-17.5		Stiff blue clay, coarse gravel, little clay
			-17.5	-27.5		Stiff clay
			-27.5	-46		Stiff or medium stiff blue clay
88	472	do	+15	- 5.0		Water and air
			- 5.0	-13.2		Soft mud
			-13.2	-47.9		Soft blue clay
			-47.9	-68.8		Hard sand, gravel, clay
			-68.8	-72.8		Very fine cemented sand
89	830	do	-10	-12		Soft black silt
			-12	-18		Fine sharp sand
			-18	-20		Clay, sand, gravel, stones
			-20	-27		Hard yellow clay, sand
			-27	-30		Hard yellow clay
			-30	-46		Hard blue clay
			-46	-56		Clay, sand, gravel, hard

TABLE 20 SUBSURFACE DATA BY OTHERS
(Continued)

CDM Boring No.	Reference: Boring No.	Reference: Source	Elevation (Boston City Base): From	Elevation (Boston City Base): To	Blows Per Foot	Description
91	17	M.D.C. Connection to Columbus Park Headworks	+17.9	+ 8.4	22	Medium sand, gravel, red brick and misc. fill
			+ 8.4	+ 1.9	4	Soft peat and little silt
			+ 1.9	- 1.6	7	Loose, sand, gravel, clay
			- 1.6	- 6.1	24	Medium coarse gray sand and gravel
			- 6.1	-12.6	21	Medium coarse gray sand and gravel
			-12.6	-14.1	8	Medium gray clay
			-14.1	-25.1	7	Medium gray clay
92	2c	BRA - Downtown Waterfront, Faneuil Hall Area	+17.33	+16.23		Concrete and blacktop
			+16.23	+ 2.33		No samples
			+ 2.33	- 4.67	25	Dark organic gray silt, gravel, and other misc. fill
			- 4.67	-44.67	37	Gray, sandy, silty clay, some fine gravel and shale
93	1A	do	+17.9	+16.4		Concrete and blacktop
			+16.4	+10.9	22	Fine to medium silty sand and some fine to coarse gravel fill
			+10.9	+ 3.9	-	Organic silt and wood
			+ 3.9	- 7.1	32	Hard sandy yellow clay, little fine gravel
			- 7.1	-47.1	40	Fine sand, little fine to coarse gravel, and some shale - Till
94	278	B.S.C.E. Boring Data from Greater Boston	+15	+ 8		Fill
			+ 8	+ 2		Peat
			+ 2	+ 1		Medium blue clay
			+ 1	- 5		Hard yellow clay, fine sand
			- 5	-10		Medium yellow clay
			-10	-15		Medium blue clay

TABLE 20 SUBSURFACE DATA BY OTHERS
(Continued)

CDM Boring No.	Reference: Boring No.	Reference: Source	Elevation (Boston City Base): From	Elevation (Boston City Base): To	Blows Per Foot	Description
95	17	B.S.C.E. Boring Data from Greater Boston	+ 21	- 15		Overburden
			- 15			Stops in gravel
96	36	D.P.W. - Roxbury Canal and Dorchester Brook Conduits	+ 3.4	- 5.6	3	Organic river silt and gravel
			- 5.6	- 8.6	3	Organic silty sand and shells
			- 8.6	- 12.6	16	Very stiff yellow clay
			- 12.6	-117.6	4	Medium blue clay
			-117.6	-119.6	35	Hard blue sandy clay
			-119.6	-122.6	55	Fine sand, clay, and some coarse gravel till
97	3	White Fuel Co. - Borings for Oil Tanks	+ 24	+ 18	50	Mixed fill
			+ 18	+ 9	20	Sand and gravel
			+ 9	+ 5	20	Sand and gravel, odor of oil
			+ 5	- 4	16	Sand and gravel
			- 4	- 9	30	Fine sand, trace of clay
			- 9	- 12	28	Fine sand, gravel, clay
98	42	White Fuel Co. - Borings for Oil Tanks	+ 13	- 4	--	Miscellaneous fill
			- 4	- 7	2	Soft silt, sand, little fine gravel
			- 7	- 27	10	Fine, coarse sand and gravel
			- 27	- 46	36	Hard coarse sand, gravel, and boulders
			- 46	- 62	48	Hard sand, gravel, and little clay
			- 62	- 69	42	Hard blue clay

NOTES:
1. Boring locations are shown in plan on Fig. D.
2. Borings listed are considered representative of many borings taken by others in nearby locations.

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXpert 1-4300

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 8 ft.

BORING #6

GROUND SURFACE ELEV. 18.0

1'6"	HOT TOP & STONES, CONCRETE	
	VERY HARD, SAND, GRAV. STONES FILL	54
2'6"	LOOSE SAND, GRAVEL, STONES, FILL	7
7'6"	LOOSE SAND, CINDERS, LITTLE GRAVEL, TRACE OF BRICK FILL	4
12'0"	LOOSE SAND, CINDERS, GRAVEL, TRACE BRICK FILL	3
17'6"	WOOD	
18'6"	ORGANIC SILT, TRACE OF FINE SAND, SHELLS	3
23'6"	ORGANIC SILT, TRACE OF FINE SAND, SHELLS	3
28'6"	ORGANIC SILT, TRACE OF FINE SAND, SHELLS	3
31'0"	ORGANIC SILT, LITTLE FINE SAND, TRACE OF SHELLS	1
36'0"	ORGANIC SILT, LITTLE FINE SAND, TRACE OF SHELLS	3
41'0"	ORGANIC SILT, TRACE OF FINE SAND,	4
45'0"		

WATER LEVEL 9'6" (TIDE)
BELOW GROUND SURFACE

DATE 6-2-67

BORING #7

GROUND SURFACE ELEV. 23.0

2'0"	FIRM SAND, SOME GRAVEL FILL	11
6'0"	LOOSE SAND, LITTLE GRAVEL, TRACE OF STONES, CLAY FILL	4
11'0"	FIRM SAND, & GRAVEL, TRACE OF CLAY FILL	10
17'0"	FIRM FINE SAND, SOME GRAVEL & CLAY FILL	10
19'0"	PEAT	3
20'0"	LOOSE FINE SAND, SOME CLAY	8
25'0"	ORGANIC SILT, LITTLE SHELLS	3
30'0"	ORGANIC SILT, TRACE OF SHELLS	2
36'0"	ORGANIC SILT, TRACE OF FIBRES, SHELLS	2
37'6"	HARD BLUE CLAY, TRACE FINE SAND	16

WATER LEVEL 9'0" (TIDE)
BELOW GROUND SURFACE

DATE 6-1-67

BORING #8

GROUND SURFACE ELEV. 13.0

1'0"	FIRM SAND, LITTLE CINDERS FILL	9
4'0"	FIRM SAND, GRAVEL, SOME STONES, TRACE BRICK FILL	18
6'6"	LOOSE SAND, CINDERS FILL	8
7'6"	FIRM SAND, GRAVEL & STONES FILL	14
9'0"	FIRM SAND & GRAVEL FILL	22
10'0"	FIRM SAND, SOME BRICK TRACE GRAV. FILL	13
14'0"	VERY HARD SAND, & GRAVEL, TRACE TAR FILL	66
18'0"	LOOSE SAND, SOME GRAVEL STONES FILL	8
23'0"	ORGANIC SILT, TRACE SAND, GRAVEL	4
30'0"	PEAT	4
31'0"	ORGANIC SILT	8
33'0"	MEDIUM BLUE CLAY, TRACE OF FINE SAND, GRAVEEL	16

WATER LEVEL 5'0" (TIDE)
BELOW GROUND SURFACE

DATE 5-31-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #9

GROUND SURFACE ELEV. 16.0

0'0"	FIRM SAND, GRAVEL, TRACE OF BRICK, COAL ASHES FILL	14
6'6"	LOOSE SAND, GRAVEL, LITTLE BRICK FILL	5
10'6"	ORGANIC SILT, WOOD, TRACE OF BRICK FILL	48
12'6"	ORGANIC SILT	5
20'0"	ORGANIC SILT	6
30'0"	HARD YELLOW CLAY	14
35'0"		

WATER LEVEL 12'0" (TIDE)
BELOW GROUND SURFACE

DATE 5-1-67

BORING #10

GROUND SURFACE ELEV. 28.0

0'0"	HARD SAND, GRAVEL, SOME BRICK, STONES FILL	42
3'0"	VERY HARD, SAND, GRAVEL FILL	74
10'0"	FIRM SAND, SOME GRAVEL, WOOD BRICK	28
11'6"		

- OBSTRUCTION -

NO WATER ENCOUNTERED

DATE 5-17-67

BORING #10-A
(7'0" SOUTH OF ORIGINAL LOCATION)

GROUND SURFACE ELEV. 17.0

0'0"	HARD SAND, GRAVEL, STONES FILL	40
5'0"	HARD SAND, GRAVEL, STONES, LITTLE WOOD FILL	32
10'0"		

- OBSTRUCTION -

NO WATER ENCOUNTERED

DATE 5-17-67

BORING #10-B

GROUND SURFACE ELEV. 17.0

0'0"	FIRM SAND, GRAVEL, TRACE STONES FILL	24
5'0"	FIRM SAND, GRAVEL, STONES FILL	16
8'0"	FIRM SAND, GRAVEL, SOME WOOD FILL	12
13'0"	LOOSE SAND, GRAVEL, STONES, LITTLE BRICK FILL	4
18'0"	ORGANIC SILT, TRACE SAND, GRAVEL	1
20'0"	LOOSE SAND, GRAVEL, STONES, BRICK, ORGANIC SILT FILL	3
23'0"	ORGANIC SILT, TRACE SHELLS, GRAVEL	4
26'0"	MEDIUM BLUE CLAY, VEINS OF FINE SAND	6
28'0"	HARD YELLOW CLAY, TRACE FINE SAND	22
32'0"	FIRM FINE SAND, LITTLE CLAY	16
34'6"		

WATER LEVEL 9'0" (TIDE)
BELOW GROUND SURFACE

DATE 5-18-67

NOTE: THIS BORING MADE 50'0" FROM BORING NO. 10

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #11

GROUND SURFACE ELEV. 15.0

1'6"	LOAMY SAND	12
	FIRM SAND, LITTLE GRAVEL, SOME CLAY FILL	10
8'0"	LOOSE SAND FILL	2
11'0"	LOOSE SAND FILL	2
16'0"	MEDIUM YELLOW CLAY, TRACE FINE SAND	8
18'6"	HARD YELLOW CLAY, VEINS OF FINE SAND	20
20'0"	FIRM FINE SAND, LITTLE CLAY	12
25'0"		

WATER LEVEL 4'6" BELOW GROUND SURFACE DATE 5-18-67

BORING #12

GROUND SURFACE ELEV. 15.5

	LOAMY SAND, GRAVEL, STONES FILL	15
4'0"	CLAY, TRACE GRAVEL FILL	12
5'0"	LOOSE SAND FILL	8
6'6"	ORGANIC SILT, TRACE OF SHELLS	4
10'0"	ORGANIC SILT, TRACE OF SHELLS	2
15'0"	ORGANIC SILT, TRACE OF SHELLS	4
20'0"	ORGANIC SILT, TRACE OF SHELLS, FIBRES	3
25'0"	ORGANIC SILT, TRACE OF FIBRES	3
30'6"	HARD YELLOW & BLUE CLAY, TRACE SAND, STONES	19
33'6"	MEDIUM YELLOW CLAY	10
38'6"	MEDIUM YELLOW CLAY	8
43'6"	MEDIUM YELLOW CLAY	6

BORING 12 CONTINUED AT LEFT

BORING 12 (CONTINUED)

48'6"	MEDIUM TO SOFT YELLOW CLAY	6
53'6"	SOFT YELLOW CLAY	5
59'6"	FIRM FINE SAND & CLAY, LITTLE GRAVEL	20
62'0"	VERY HARD, FINE SAND, GRAVEL & STONES	120
65'6"		

- REFUSAL - (120 BLOWS, NO PENETRATION)

WATER LEVEL 6'0" (TIDE) BELOW GROUND SURFACE

DATE 5-18-67

BORING #13

GROUND SURFACE ELEV. 15.0

	LOOSE FINE SAND FILL	4
1'0"	FIRM SAND, LITTLE GRAVEL FILL	14
4'6"	ORGANIC SILT, TRACE FINE SAND, SHELLS	3
8'0"	MEDIUM TO SOFT YELLOW CLAY	4
10'0"	MEDIUM YELLOW CLAY, VEINS OF FINE SAND FILL	7
13'0"	FIRM SAND, TRACE GRAVEL, CLAY FILL	13
15'0"	ORGANIC SILT, TRACE FINE SAND, SHELLS, GRAVEL	5
20'0"	ORGANIC SILT, TRACE FINE SAND, SHELLS, GRAVEL	5
22'6"	ORGANIC SILT, TRACE OF SHELLS, FIBRES	3
26'6"	HARD YELLOW CLAY, TRACE FINE SAND	10
29'0"		

WATER LEVEL (TIDE)

DATE 5-22-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION
37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAM, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #14

GROUND SURFACE ELEV. 14.0

	FIRM SAND, GRAVEL FILL	12
6'0"	CLAY, TRACE OF SAND FILL	14
8'0"	FIRM SAND, SOME GRAVEL, STONES FILL	12
10'0"	LOOSE SAND, CINDERS, GRAVEL, STONES FILL	3
12'6"	ORGANIC SILT, TRACE FINE SAND FILL	2
14'0"	HARD YELLOW CLAY, VEINS OF FINE SAND	16
16'0"	LOOSE FINE SAND	5
17'0"	FIRM FINE SAND & CLAY	12
19'6"	LOOSE FINE SAND	8
22'0"	MEDIUM YELLOW CLAY	9
24'0"		

WATER LEVEL (TIDE)

DATE 5-22-67

BORING #15

GROUND SURFACE ELEV. 17.0

1'0"	FINE SAND FILL	3
3'6"	FIRM SAND, GRAVEL, STONES, TRACE BRICK FILL	23
6'6"	SAND, GRAVEL, TRACE OF CLAY FILL	8
9'0"	ORGANIC SILT, TRACE FIBRES	4
10'0"	LOOSE FINE SAND, LITTLE CLAY	5
15'0"	MEDIUM YELLOW CLAY, VEINS OF FINE SAND	9
20'0"	HARD YELLOW CLAY	24
25'6"	FIRM FINE SAND	14
27'0"	HARD YELLOW CLAY	16

WATER LEVEL 9'0" (TIDE)
BELOW GROUND SURFACE

DATE 5-23-67

BORING #16

GROUND SURFACE ELEV. 16.0

	FIRM SAND, GRAVEL, STONES, TRACE OF CLAY FILL	14
5'0"	LOOSE SAND, GRAVEL, SOME CLAY FILL	6
11'0"	PEAT	4
13'0"	LOOSE PEATY SAND	6
14'6"	FIRM FINE SAND	22
15'6"	FIRM MEDIUM SAND	12
18'6"	FIRM MEDIUM SAND, SOME GRAVEL, STONES	27
24'0"		

WATER LEVEL 8'0" (TIDE)
BELOW GROUND SURFACE

DATE 5-23-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 4 OF 15

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION
37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #17

GROUND SURFACE ELEV. 14.5

0'0"	FIRM SAND, GRAVEL FILL	14
4'0"	FIRM SAND & GRAVEL FILL	22
9'0"	ORGANIC SILTY SAND	4
10'0"	PEAT	3
12'0"	FIRM COARSE SAND, SOME GRAVEL	12
13'6"	HARD YELLOW CLAY, TRACE FINE SAND	18
18'0"		

WATER LEVEL 4'0" (TIDE)
BELOW GROUND SURFACE

DATE 5-24-67

BORING #18

GROUND SURFACE ELEV. 15.5

0'0"	HOT TOP	
0'6"	FIRM SAND, GRAVEL, STONES FILL	14
4'6"	CLAY, LITTLE FINE SAND, TRACE ORGANIC SILT	5
9'0"	ORGANIC SILT, TRACE FINE SAND	5
14'6"	ORGANIC SILTY SAND, SOME GRAVEL	4
15'6"	FIRM ORGANIC SILTY SAND, GRAVEL & STONES	14
18'0"	FIRM FINE SAND, SOME STONES	22
20'6"		

WATER LEVEL 4'6" (TIDE)
BELOW GROUND SURFACE

DATE 5-24-67

BORING #19

GROUND SURFACE ELEV. 15.5

0'0"	LOOSE LOAMY SAND	6
1'6"	FIRM LOAMY SAND, TRACE GRAVEL, SHELLS FILL	12
3'6"	FIRM SAND, GRAVEL FILL	18
5'0"	LOOSE SAND, GRAVEL FILL	7
7'6"	FIRM MEDIUM SAND & GRAVEL	21
12'0"	FIRM COARSE SAND, GRAVEL	24
17'0"		

WATER LEVEL 8'0" (TIDE)
BELOW GROUND SURFACE

DATE 4-27-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 5 OF 15

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" - 4 ft.

BORING #20

GROUND SURFACE ELEV. 14.0

	LOOSE MEDIUM SAND, LITTLE CINDERS FILL	5
5'0"	LOOSE SAND, CINDERS FILL	4
10'0"	LOOSE CINDERS, TRACE SAND FILL	2
15'0"	LOOSE CINDERS, TRACE ORGANIC SILT, STONES FILL	3
18'6"	ORGANIC SILT, TRACE OF SHELLS	4
21'0"	PEAT	3
26'0"	PEAT	3
28'0"	BLUE CLAY, LITTLE ORGANIC SILT	4
29'6"	LOOSE FINE SAND & CLAY	6
31'0"	MEDIUM BLUE CLAY	11
33'0"		

WATER LEVEL 12'0" BELOW GROUND SURFACE DATE 5-20-67

BORING #21

BORING #21-A

GROUND SURFACE ELEV. 16.0

	LOOSE SAND, CINDERS, LITTLE GRAVEL FILL	4
3'0"	LOOSE CLAY, SAND, TRACE ORG. SILT FILL	3
4'6"	SOFT BLUE CLAY, LITTLE FINE SAND FILL	4
8'0"	BLUE CLAY FILL	3
15'6"	PEAT	3
22'6"	SOFT BLUE CLAY	3
23'6"	HARD YELLOW CLAY, TRACE FINE SAND	11
25'0"	HARD YELLOW CLAY, TRACE FINE SAND	20
27'0"		

WATER LEVEL 7'0" BELOW GROUND SURFACE

DATE 5-17-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAPP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #22

GROUND SURFACE ELEV. 19.0

1'0"	HOT TOP & CONCRETE	
	FIRM SAND, GRAVEL, STONES FILL	20
6'0"	FIRM SAND, GRAVEL, STONES FILL	22
11'0"	PEAT	6
14'6"	FIRM FINE SAND	20
17'0"	FINE SAND, SOME CLAY	5
20'6"	MEDIUM YELLOW CLAY, SOME FINE SAND	9
22'6"	MEDIUM YELLOW CLAY, SOME FINE SAND	12
24'0"	FIRM FINE TO MEDIUM SAND	9
31'6"	FIRM FINE SAND, SOME CLAY	12
34'0"		

WATER LEVEL 7'0" BELOW GROUND SURFACE

DATE 5-11-67

BORING #23

GROUND SURFACE ELEV. 16.5

1'0"	HOT TOP & CONCRETE	
	FIRM SAND, GRAVEL, STONES FILL	18
4'0"	FIRM SAND, GRAVEL, STONES FILL	26
7'6"	ORGANIC SILT, LITTLE SAND, FILL	5
8'6"	FINE SAND, SOME ORG. SILT, TRACE CLAY FILL	3
9'6"	HARD YELLOW CLAY, VEINS OF FINE SAND	22
11'0"	MEDIUM YELLOW CLAY, TRACE OF FINE SAND	13
16'0"	MEDIUM YELLOW CLAY, VEINS OF FINE SAND	12
19'6"	SOFT BLUE CLAY	4
23'0"	SOFT BLUE CLAY	4
28'0"	SOFT BLUE CLAY	4
33'0"	SOFT BLUE CLAY	3
38'0"	MEDIUM BLUE CLAY	8
44'0"		

WATER LEVEL 7'6" BELOW GROUND SURFACE

DATE 5-12-67

BORING #24

GROUND SURFACE ELEV. 16.0

1'0"	HOT TOP & CONCRETE	
	FIRM SAND & GRAVEL FILL	11
2'6"	LOOSE SAND, SOME GRAVEL FILL	7
8'6"	ORGANIC SILT, SOME FIBRES	4
13'6"	PEAT	3
17'6"	PEATY SAND	4
18'6"	FIRM FINE SAND, SOME CLAY	12
20'0"	HARD YELLOW CLAY	20
21'6"	MEDIUM BLUE CLAY, VEINS OF FINE SAND	10
25'0"	MEDIUM TO SOFT BLUE CLAY	6
31'0"		

WATER LEVEL 6'0" BELOW GROUND SURFACE

DATE 5-10-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 2 OF 15

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXpert 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #25

GROUND SURFACE ELEV. 16.0

1'0"	HOT TOP & CONCRETE	
	FIRM SAND, GRAVEL, STONES FILL	17
5'0"	FIRM SAND, GRAVEL, STONES FILL	22
6'6"	LOOSE FINE SAND, SOME ORGANIC SILT	4
8'0"	LOOSE SAND, TRACE OF ORGANIC SILT	6
9'0"	FIRM MEDIUM SAND	12
11'0"	FIRM FINE SAND & CLAY	18
15'6"	MEDIUM BLUE CLAY, VEINS OF FINE SAND	10
20'6"	MEDIUM BLUE CLAY	10
22'0"	SOFT BLUE CLAY	4
27'0"	SOFT BLUE CLAY	5
31'0"		

WATER LEVEL 6'0" BELOW GROUND SURFACE

DATE 5-9-67

BORING #26

GROUND SURFACE ELEV. 17.0

1'0"	HOT TOP & CONCRETE	
	FIRM SAND, SOME GRAVEL FILL	26
2'6"	FIRM SAND, TRACE OF GRAVEL FILL	18
5'0"	FIRM SAND, TRACE OF GRAVEL FILL	20
7'0"	PEATY SAND, LITTLE GRAVEL	2
9'0"	LOOSE PEATY SAND	4
11'6"	FIRM FINE SAND	28
13'0"	FIRM MEDIUM TO COARSE SAND, SOME GRAVEL, STONES, TRACE OF CLAY	16
15'0"	FIRM SAND & CLAY, TRACE OF GRAVEL	24
20'0"	MEDIUM BLUE CLAY	10
25'0"	MEDIUM BLUE CLAY	10
29'0"	SOFT BLUE CLAY	6
		6
		7
		6

BORING 26 CONTINUED AT RIGHT

BORING #27

GROUND SURFACE ELEV. 22.0

0'6"	HOT TOP	
	FIRM SAND & GRAVEL FILL	16
4'0"	FIRM SAND & GRAVEL FILL	13
9'0"	FIRM FINE SAND, GRAV. STONES, CLAY	40
10'6"	HARD YELLOW CLAY, VEINS OF FINE SAND	20
15'0"	HARD YELLOW CLAY, VEINS OF FINE SAND, FINE GRAVEL	22
20'6"	- REFUSAL - (120 BLOWS, NO PENETRATION)	

WATER LEVEL 4'0" BELOW GROUND SURFACE

DATE 5-5-67

BORING 26 (CONTINUED)

50'0"

WATER LEVEL 7'0" BELOW GROUND SURFACE

DATE 5-8-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #28

GROUND SURFACE ELEV. 18.0

2'0"	FIRM SAND, GRAVEL, STONES FILL	9
	FIRM SAND, GRAVEL, BRICK FILL	14
4'0"	LOOSE SAND, SOME GRAVEL FILL	8
9'6"	LOAMY SAND, TRACE OF GRAVEL	3
10'0"	LOOSE SAND, LITTLE GRAVEL, SILT FILL	2
11'6"	LOOSE FINE SAND, LITTLE GRAVEL, CLAY	5
12'6"	LOOSE FINE SAND, LITTLE CLAY	8
14'0"	HARD YELLOW CLAY, TRACE OF FINE SAND	12
17'0"	FIRM FINE SAND	13
21'0"	FIRM FINE SAND & CLAY	12
23'6"	FIRM FINE SAND	13 14
30'0"	FIRM FINE SAND & CLAY	24
31'0"	FIRM FINE SAND	12
37'0"	FIRM FINE SAND	9
40'6"		

WATER LEVEL 8'0"
BELOW GROUND SURFACE

DATE 5-4-67

BORING #29

GROUND SURFACE ELEV. 15.5

2'0"	LOOSE LOAMY SAND, TRACE OF GRAVEL	8
	LOOSE SAND, ASHES FILL	3
5'0"	WOOD	8
7'0"	SAND, GRAVEL, ASHES, GLASS, BRICK FILL	5
12'0"	FIRM FINE SAND, SOME CLAY	14
16'6"	HARD YELLOW CLAY, TRACE OF GRAVEL	20
19'6"	MEDIUM BLUE CLAY	5
23'0"	SOFT BLUE CLAY, SOME FINE SAND	4 4 4
36'6"	SOFT BLUE CLAY	3 4
45'0"		

WATER LEVEL 4'0"
BELOW GROUND SURFACE

DATE 5-16-67

BORING #30

GROUND SURFACE ELEV. 16.0

2'0"	LOAMY SAND, LITTLE GRAVEL	8
	LOOSE ASHES FILL	2
8'6"	SAND, GRAVEL, CLAY, LITTLE ORG. SILT FILL	5
9'6"	SAND, SOME CLAY, GRAVEL FILL	8
16'0"	ORGANIC SILT, CLAY, TRACE SHELLS FILL	5
18'6"	PEAT	4
19'6"	ORGANIC SILT, TRACE SHELLS	5
25'0"	HARD YELLOW CLAY, VEINS OF FINE SAND	13
30'0"	HARD YELLOW CLAY, VEINS OF FINE SAND	14
32'0"		

WATER LEVEL 3'6"
BELOW GROUND SURFACE

DATE 4-27-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #31
(OMITTED)

BORING #32

GROUND SURFACE ELEV. 17.5

	HOT TOP & COBBLE STONES	
1'6"	FIRM SAND, GRAVEL, STONES FILL	24
4'0"	FIRM SAND, GRAVEL, STONES FILL	12
8'0"	FIRM SAND, GRAVEL, STONES, SOME CLAY FILL	10
13'0"	ORGANIC SILT	6
17'0"	ORGANIC SILT	5
20'0"		

WATER LEVEL 7'0"
BELOW GROUND SURFACE

DATE 6-5-67

BORING #33

GROUND SURFACE ELEV. 17.5

	HOT TOP & STONES	
1'0"	FIRM MEDIUM SAND & GRAVEL	26
3'0"	HARD FINE SAND, GRAVEL & STONES	38
7'0"	FIRM FINE SAND, SOME GRAVEL & STONES	14
9'0"	FIRM FINE SAND, GRAVEL	24
10'6"	FIRM MEDIUM SAND, GRAVEL & STONES	12
12'0"	FIRM MEDIUM SAND	17
14'0"	FIRM FINE SAND	22
19'0"		

WATER LEVEL 8'0"
BELOW GROUND SURFACE

DATE 6-6-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 10 OF 15

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #34

GROUND SURFACE ELEV. 18.0

0'6"	HOT TOP	
	FIRM SAND, GRAVEL, CINDERS, ASHES FILL	12
2'0"	LOOSE SAND, ASHES FILL	4
7'0"	FIRM SAND, GRAVEL, SOME STONES, LITTLE CLAY FILL	18
11'6"	LOOSE SAND, SOME GRAV. STONES FILL	7
13'6"	FIRM SAND, GRAVEL, TRACE OF CLAY	11
15'6"	MEDIUM BLUE CLAY, FINE SAND, GRAV. STONES	13
17'0"	HARD YELLOW CLAY, TRACE FINE SAND	15
20'0"	HARD YELLOW CLAY, TRACE FINE SAND	18
25'0"		

WATER LEVEL 11'6" BELOW GROUND SURFACE

DATE 6-7-67

BORING #35 (OMITTED)

BORING #36

GROUND SURFACE ELEV. 30.0

	FIRM SAND & GRAVEL, STONES, TRACE BRICK FILL	20
4'0"	FIRM FINE SAND, TRACE OF GRAVEL	18
8'0"	FIRM FINE SAND, TRACE OF GRAV. CLAY	28
9'0"	VERY HARD, FINE SAND GRAVEL, STONES	88
10'0"		

- REFUSAL - (120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 6-8-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 11 OF 15

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #37

GROUND SURFACE ELEV. 18.0

	LOOSE LOAMY SAND, TRACE OF CINDERS, COAL FILL	5
5'6"	FIRM SAND, GRAVEL, STONES FILL	14
7'0"	HARD SAND, GRAVEL, STONES FILL	34
8'0"	FIRM SAND, SOME GRAVEL FILL	11
11'6"	LOOSE SAND, GRAVEL, STONES FILL	6
15'0"	LOOSE PEATY SAND & GRAVEL	4
16'6"	MEDIUM BLUE CLAY, VEINS OF FINE SAND	9
19'0"	HARD YELLOW CLAY, VEINS OF FINE SAND	17
25'6"	SOFT YELLOW CLAY, VEINS OF FINE SAND	6
27'0"	SOFT BLUE CLAY, VEINS OF FINE SAND	4
29'0"	SOFT BLUE CLAY	5
31'0"		

WATER LEVEL 9'0" BELOW GROUND SURFACE

DATE 6-8-67

BORING #38

GROUND SURFACE ELEV. 24.0

0'6"	HOT TOP	
1'6"	FIRM SAND, GRAVEL, FILL	13
5'6"	FIRM SAND, SOME GRAVEL FILL	21
12'6"	FIRM MEDIUM SAND, SOME GRAVEL	27
18'0"	HARD MEDIUM SAND, SOME GRAVEL	42

NO WATER ENCOUNTERED

DATE 4-28-67

BORING #39

GROUND SURFACE ELEV. 21.0

1'0"	HOT TOP & CONCRETE	
6'6"	VERY HARD SAND, GRAVEL, STONES FILL	52
12'0"	VERY HARD, SAND, GRAVEL, STONES FILL	76
18'0"	HARD MEDIUM SAND, SOME GRAVEL	40

NO WATER ENCOUNTERED

DATE 4-28-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ± G-17

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #40

GROUND SURFACE ELEV. 38.5

1'0"	HOT TOP & CONCRETE	
	HARD SAND, GRAVEL, STONES, CEMENT FILL	46
4'6"	FIRM SAND, TRACE OF GRAVEL, STONES FILL	27
5'6"	FIRM FINE SAND & GRAVEL	29
8'6"	VERY HARD FINE SAND, SOME GRAVEL	96
11'6"		

- REFUSAL -
(120 BLOWS, NO PENETRATION)

NO WATER ENCOUNTERED

DATE 4-28-67

BORING #41

GROUND SURFACE ELEV. 27.0

1'0"	HOT TOP & CONCRETE	
	HARD FINE SAND, GRAVEL, SOME STONES	31
4'0"	LOOSE SAND, SOME GRAVEL, CLAY	6
9'6"	LOOSE SAND, GRAVEL, SOME STONES, CLAY	6
15'6"	FIRM MEDIUM SAND	28
18'0"		

WATER LEVEL 13'6" BELOW GROUND SURFACE

DATE 5-5-67

BORING #42

GROUND SURFACE ELEV. 32.0

1'6"	FIRM SAND, GRAVEL, CINDERS FILL	15
	HARD SAND, GRAVEL, STONES, TRACE OF CLAY	45
4'6"	FINE SAND & YELLOW CLAY	12
6'0"	FIRM FINE SAND SOME CLAY	20
9'6"	HARD YELLOW CLAY, LITTLE GRAVEL, FINE SAND	24
12'0"	FIRM FINE SAND, SOME GRAVEL, LITTLE CLAY	25
15'0"	HARD FINE SAND, GRAVEL, STONES, LITTLE CLAY	45
18'0"		

WATER LEVEL 4'0" BELOW GROUND SURFACE

DATE 5-15-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION
37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #43
(OMITTED)

BORING #44
(OMITTED)

BORING #45

GROUND SURFACE ELEV. 17.5

0'6"	HOT TOP	
	FIRM SAND, GRAVEL, SOME STONES, CINDERS FILL	24
3'0"		
	FIRM SAND, GRAVEL & STONES	14
7'0"		
	PEAT	4
		2
13'6"		
	FIRM MEDIUM SAND, GRAVEL, TRACE OF CLAY	14
17'0"		
	HARD YELLOW CLAY, TRACE FINE SAND	26
22'0"		

WATER LEVEL 6'0"
BELOW GROUND SURFACE

DATE 6-15-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 14 OF 15

CARR-DEE TEST BORING AND CONSTRUCTION CORPORATION

37 LINDEN STREET MEDFORD, MASSACHUSETTS 02155 Telephone EXport 1-4500

To CAMP, DRESSER & McKEE, ENGINEERS, BOSTON, MASS. Date JUNE 26, 1967 Job No. 67122

Location BOSTON SEWER REPORT, MASS. Scale 1" = 4 ft.

BORING #46

GROUND SURFACE ELEV. 18.0

0'6"	HOT TOP	
	VERY HARD, SAND, GRAVEL, STONES FILL	52
3'0"	LOOSE MEDIUM SAND, GRAVEL, STONES, TRACE OF CLAY	8
9'0"	PEAT	4
14'0"	FIRM MEDIUM SAND & GRAVEL	26
15'0"	HARD COARSE SAND GRAVEL, LITTLE STONES	30
19'0"		

WATER LEVEL 6'0" BELOW GROUND SURFACE

DATE 6-15-67

UNLESS OTHERWISE SPECIFIED, WATER LEVELS NOTED, WERE OBSERVED AT COMPLETION OF BORINGS, AND DO NOT NECESSARILY REPRESENT PERMANENT GROUND WATER LEVELS. FIGURES IN RIGHT HAND COLUMN INDICATE NUMBER OF BLOWS REQUIRED TO DRIVE 2" O.D. SPLIT TUBE SAMPLER 12 INCHES USING 140 LB. WEIGHT FALLING 30 INCHES ±

SHEET 15 OF 15

APPENDIX H

APPENDIX H

BIBLIOGRAPHY

The list which follows includes the significant references to information utilized during the preparation of this report. We have referred, of course, to many documents, maps, and photographs, including records of hearings and correspondence with State and City agencies and their engineering consultants. We have also used photographs of sewer examinations. aerial photographs, publications of the Greater Boston Chamber of Commerce, U.S. Government publications such as those of the Geological Survey, the Coast and Geodetic Survey and the Weather Bureau, construction and record drawings of the Boston Public Works Department Sewer Division, and plans of the Boston Redevelopment Authority, the Massachusetts Bay Transportation Authority (formerly the Boston Transit Commission), the Massachusetts Department of Public Works, the Metropolitan District Commission, and other agencies.

The following bibliography is tabulated in chronological order.

1. "Main Drainage Works of the City of Boston", by E.C. Clarke, 1885

2. "Report of a Commission appointed to Consider a General System of Drainage for the Valleys of Mystic, Blackstone and Charles Rivers, Massachusetts, U.S.A.", Massachusetts Drainage Commission, with report of J.P. Davis and R. Hering, and report of E.C. Clarke, 1886

3. "Report of the State Board of Health upon the Sewerage of the Mystic and Charles River Valleys", Senate No. 2, with reports of J.P. Davis, H.A. Carson, F.P. Stearns, C.H. Swan, and F. Brooks, 1889

4. "Report of the State Board of Health upon the Discharge of Sewage into Boston Harbor," Ch. 65 Resolves of 1899, with report of H. Mills, 1900

5. "Report of the Committee on Charles River Dam, appointed under Resolves of 1901, Ch. 105, to consider the Advisability and Feasibility of Building a Dam across the Charles River at or near Craigie Bridge," Boston, with Report of J.R. Freeman, Chief Engineer, and appendices, 1903

6. "Annual Reports, City of Boston, Public Works Department, Sewer Division", 1904 & 1960-66 inclusive

7. "Report on the Adequacy of the Present Sewerage System of the Back Bay District of Boston, Massachusetts, and the Effect of Carrying Storm Water in Inverted Siphons under the Contemplated Subway in the New Charles River Embankment," by E. Kuichling and H.F. Bryant, 1911

8. "South End Sewer System of Boston," by E.S. Dorr, Jour., BSCE, Vol. II, No. 10, 1915

9. "Report of Joint Board on Conditions of South Bay", House Doc. 1635, 1915

10. "Geology of Massachusetts and Rhode Island", by B.K. Emerson, Bulletin No. 597, U.S. Geological Survey, 1917

11. "Report of the Joint Board acting under the Provision of Chapter 56 of the Resolves of 1917 Providing for an Investigation of the Discharge of Sewage into Boston Harbor", House Doc. 1215, 1918

12. "Earthquake Risk in Boston", by I.B. Crosby, Jour., BSCE, Vol. 10, No. 10, 1923

13. "The Metropolitan Sewerage Works, Boston, Mass.", by R.W. Loud, Jour., BSCE, Vol. 10, No. 8, 1923

14. "Tides and Currents in Boston Harbor", U.S. Coast and Geodetic Survey, Spec. Publ. No. 142, 1928

15. "Report of the Special Commission Established to Investigate Further the Advisability of Filling-In South Bay and Part of Fort Point Channel in Boston Harbor", created by Chapter 23 of the Resolves of 1927, House Doc. 1010, 1928

16. "Report of the Special Commission Relative to the Discharge of Sewage into Boston Harbor under Chapter 29, Resolves of 1929", Senate Doc. 56, 1930

17. "Special Report of the Department of Public Health and the Metropolitan District Commission Relative to Increasing the Capacity of the Charles River Valley Sewer, (So. Met. Distr.), under Ch. 40 Resolves of 1931", House Doc. 159, 1931

18. "Structural Design of East Boston Vehicular Tunnel (Sumner Tunnel)", by B.A. Loveland, Jour., BSCE Mar., Vol. 19, No. 3, 1932

19. "Geology of the Boston Area, Massachusetts", U.S. Geological Survey, Bull. No. 839, by L. LaForge, 1932

20. "Intercepting Sewers and Storm Stand-by Tanks at Columbus, Ohio", by J.H. Gregory, Trans., ASCE, Vol. 99, 1933

21. "Report of the Special Commission on the Investigation of the Discharge of Sewage into Boston Harbor and Its Tributaries", incl. report of Board of Engineers, A.D. Weston, J.N. Ferguson, J.P. Dever, M.V. Safford (M.D.), and G.W. Dakin, and of geologist I.B. Crosby, House Doc. 1600, 1936

22. "Tracing Loss of Groundwater" by B.F. Snow, Engineering News Record, July 2, 1936

23. "Report on Cooperative Studies on Sludge Dumping at the Entrance to New York Harbor", City of New York, Department of Public Works,Bureau of Sewage Disposal, 1938

24. "The Charles River Basin", by A.D. Weston, Jour., BSCE, Vol. 25, No. 4, 1938

25. "Special Report of the Metropolitan District Commission and Massachusetts Department of Public Health Relative to Sewage Pollution of the Charles River", House Doc. 1961, 1939

26. "Special Report of the Metropolitan District Commission and Massachusetts Department of Public Health Relative to Establishing a Method of Assessing Financing and Maintenance Costs on Cities and Towns in the North and South Metropolitan Sewerage Districts", House 2190, 1939

27. "Report of the Special Commission Investigating Systems of Sewerage and Sewage Disposal in the North and South Metropolitan Sewerage Districts and the City of Boston", under Ch. 79 Resolves of 1938, including report of Greeley & Hansen and Metcalf and Eddy, House Doc. 2465, 1939

28. "The Pollution of Boston Harbor", by A.D. Weston & G.P. Edwards, Trans., ASCE, Vol. 105, 1940

29. "Problems of Sewerage and Sewage Disposal in Metropolitan Boston", by H.P. Eddy, Jr. and A.L. Fales, Jour., BSCE, Vol. 27, No. 2, 1940

30. "The Pollution of Boston Harbor", by S.A. Greeley, Jour., BSCE, Vol. 27, No. 2, 1940

31. "Storage Basins as a Supplement to Storm Sewer Capacity", by J.A. Rousculp, "Civil Engineering", ASCE, Vol. 10, No. 11, 1940

32. "Sewerage and Sewage Disposal Studies (Boston, Mass.) under Chapter 512, 1939", for Metropolitan District Commission, by Metcalf & Eddy and Greeley & Hansen, 1941

    1. General Design Drawings and Final Report

    2. Supplementary volume, Technical and Progress Reports

33. "Coastal Currents along the Atlantic Coast of the U.S.", United States Coast and Geodetic Survey, Spec. Publ. 230, 1942

34. "Proposed Improvements in Sewage Disposal and Treatment in Boston Metropolitan District", by K.R. Kennison, Sewage Works Journal, Vol. 17, No. 12, 1945

35. "Loss of Sanitary Sewage Through Storm Water Overflows", by J.E. McKee, Jour., BSCE, Vol. 32, No. 2, 1947

36. "Report to Metropolitan District Commission upon Comprehensive Plan for the Relief of Storm Overflows into Charles River Basin and Extension of North Metropolitan Relief Sewer from East Boston to Deer Island", by Metcalf & Eddy, 1948

37. "Report to Joint Board, Commonwealth of Massachusetts, under Ch. 41, Resolves of 1948 upon Extension of South Metropolitan Sewerage District", by Camp, Dresser & McKee, House Doc. 2151, 1948

38. "Second Report to Joint Board, Commonwealth of Massachusetts, under Ch. 57, Resolves of 1949 upon Extension of South Metropolitan Sewerage District", by Camp, Dresser & McKee, House Doc. 2263, 1949

39. "Sewage Disposal Program of Allegheny County Sanitary Authority", by J.F. Laboon, Sewage Works Jour., Vol. 21, No. 2, 1949

40. "The Pollution of the Charles River", by M.P. Horwood, J.D. Frame and R.E. McKinney, Jour., BSCE, Vol. 37, No. 2, 1950

41. "The Pollutional Effects of Storm Water Overflows from Combined Sewers, (Detroit)", by C.L. Palmer, Sewage and Industrial Wastes, Vol. 22, No. 2, 1950

42. "Overflows", by S.G. Hess & F.G. Manning, Sewage and Industrial Wastes, Vol. 22, No. 2, 1950

43. "Engineering Report on the Comprehensive Sewage Plan of Sewage Disposal Needs and Alternate Plans", to Commonwealth of Massachusetts, Metropolitan District Commission, by Charles A. Maguire and Associates, 1950

44. "Engineering Report on a Proposed Plan of Sewerage and Sewage Disposal for the Boston Metropolitan Area", to Commonwealth of Massachusetts, Metropolitan District Commission, by Charles A. Maguire and Associates, 1951

45. "Sewer Assessment Practice & Sewer Service Charges in Massachusetts", by F.L. Flood, Jour., BSCE, Vol. 39, No. 2, 1952

46. "The Allegheny County Sanitary Authority Project in Western Pennsylvania", by S.M. Dore, BSCE, Jour., Vol. 40, No. 2, 1953

47. "Tide Heights along the Coasts of the United States", by L.P. Disney, Proc., ASCE, Separate No. 666, Vol. 81, 1955

48. "Report Upon the Proposed Boston Main Drainage Relief Sewer from Camden Street at Tremont Street to Ward Street Headworks", to Commonwealth of Massachusetts, Metropolitan District Commission, by E.T. Killam, 1955

49. "Progress Report to Metropolitan District Commission on Basis of Design of Deer Island Sewage Treatment Plant", by E.T. Killam, Greeley & Hansen, and Charles A. Maguire and Associates, 1955

50. "Maintenance of the N.Y. City Intercepting Sewer System", by J.J. Rooney, Sewage and Industrial Wastes, Vol. 28, 1956

51. "Synthetic Storm Pattern for Drainage Design", by C.J. Keifer and H.H. Chu, ASCE Proc. Paper 1332, 1957

52. "Procedures and Economics of Sludge Disposal, New York City", Department of Public Works, New York City, by W.A. O'Leary, 1958

53. "Report and Basic Drawings, Proposed Inverted Siphon at Prudential Site, (Boston, Mass.)", Department of Public Works, City of Boston, Massachusetts, by Camp, Dresser & McKee, 1958

54. "Controlled Submergence of Pittsburgh's Deep Sewers", by J.F. Laboon, Jour., San. Eng. Div. ASCE,Vol. 84, SA4, Paper No. 1717, 1958 and discussion in SA-1, 1959 by E.B. Cobb and A.J. Burdoin

55. "Report upon Boston Marginal Conduit Pumping Station - Project 13", to Metropolitan District Commission by Charles A. Maguire and Associates, Greeley & Hansen, and E.T. Killam, 1958

56. "Overflows of Sanitary Sewage from Combined Sewerage Systems", by T.R. Camp, Sewage and Industrial Wastes, Vol. 31, 1959

57. "Report on Elimination of Marginal Pollution, Upper East River", to Department of Public Works, City of New York, by Greeley & Hansen, 1959

58. "Report on Elimination of Marginal Pollution, Jamaica Bay", to Department of Public Works, City of New York, by Greeley & Hansen, 1959

59 "The Deer Island Sewage Treatment Works", by P.E. Langdon, Jour., BSCE, Vol. 46, No. 4, 1959

60. "Report of the Special Commission Relative to Filling and Improving South Bay and Part of Fort Point Channel in the City of Boston", Senate Doc. 498, 1959

61. "Geology of the Main Drainage Tunnel, Boston, Massachusetts", thesis by David A. Rahm, Harvard University, 1959

62. "A Summary of the Comprehensive Construction Program (MDC Sewerage System, Boston, Massachusetts)", by F.W. Gow, "Sanitalk", (Mass. D.P.H.), Vol. 8, No. 3, 1960

63. "The Metropolitan Sewerage District (Boston, Massachusetts)", by A.E. Sulesky, "Sanitalk", (Mass. D.P.H.), Vol. 8, No. 3, 1960

64. "Allocation of Costs for the Metropolitan Sewerage System", by C.I. Sterling, Jr., Jour., BSCE, Vol. 47, No. 4, 1960

65. "Hydrology of Urban Runoff", by A.L. Tholin & C.J. Keifer, Trans. ASCE, Vol. 125, 1960

66. "Changing Times Demand New Assessment Methods for MDC Sewerage System", by A.E. Sulesky, Jour., BSCE, Vol. 47, No. 1, 1960

67. "Marine Disposal of Wastes", Progress Report of Committee, ASCE, Jour., Sanitary Engineering Div., SA-1, 1961

68. "Report to Public Works Department, City of Boston, Massachusetts, upon Sewer Use Charges", by Camp, Dresser & McKee, 1961

69. "Influence of Combined Sewers on Pollution Control", by H. Romer and L.M. Klashman, Public Works, October 1961

70. "Boring Data from Greater Boston", Boston Society of Civil Engineers, 1961

71. "Storm Water and Combined Sewage Overflows", by S.A. Greeley and P.E. Langdon, Jour., San. Eng. Div. ASCE, SA-1, Paper No. 2718, 1961

72. "Equipment, Methods and Results from Washington, D.C. Combined Sewer Overflow Studies", by C.F. Johnson, WPCF Jour., Vol. 33, No. 7, 1961

73. "Recent Investigations of Overflows from Combined Sewers in Washington, D.C.", by G.J. Moorehead, WPCF Jour., Vol. 33, No. 7, 1961

74. "Diffusers for Disposal of Sewage in Sea Water", by A.M. Rawn, F.R. Bowerman and N.H. Brooks, Trans. ASCE, Vol. 126, 1961

75. "Construction and Operation of the Pittsburgh Project", by J.F. Laboon, Jour., WPCF, Vol. 33, No. 7, 1961

76. "Report of the Boston Society of Civil Engineers Committee on Floods", Jour., BSCE, Vol. 48, No. 4, 1961

77. "Rainfall Frequency Atlas of the United States for Durations from 30-Minutes to 24-Hours and Return Periods from 1 to 100 Years", Technical Paper No. 40, Weather Bureau, U.S. Dept. of Commerce, 1961

78. "Chlorination of Mixed Sewage and Storm Water", by T.R. Camp, Trans., ASCE, Vol. 127, 1962

79. "Greater Boston Economic Study Committee, Associate Center of the Committee for Economic Development,

Economic Base Reports
1. "The Labor Force of Greater Boston", by E.J. Burtt, 1959
9. "Projections of Greater Boston's Population to 1970 and 1980", by F.L. Sweetser, 1962

Land Use Reports
1. "Land Use in Greater Boston in 1960", 1962
2. "Industrial Needs Through 1980", 1962

80. Boston Regional Survey, prepared for Mass. Transportation Commission, Commonwealth of Massachusetts, by Planning Services Group,

1. "Regional Population Trends", 1962
2. "Regional Land Use Patterns", 1962
3. "Economic Base", 1962

81. "The City Tunnel Extension (Boston, Massachusetts)", by C.J. Ginder, Jour., NEWWA, Vol. 76, No. 3, 1962

82. "Report on Preliminary Design, Spring Creek Marginal Pollution Control Project", to Department of Public Works, City of New York, by Greeley and Hansen, 1962

83. "Geology of the Main Drainage Tunnel, Boston, Massachusetts", by D.A. Rahm, Jour., BSCE, Vol. 49, No. 4, 1962

84. "Prudential Center Foundations", by D.G. Ball, BSCE, Jour., Vol. 49, No. 3, 1962

85. "Renewing Boston's Municipal Facilities, Capital Improvements Program 1963/1975", by Boston Redevelopment Authority, 1963

86. "Feasibility of Combined Sewer Systems (Detroit)", by C.L. Palmer, Jour., WPCF, Vol. 35, No. 2, 1963

87. "Interim Report on Utility Systems for East Boston GNRP Area, Mass. R-44", to Boston Redevelopment Authority, by Charles A. Maguire and Associates, 1963

88. "Interim Report on Utility Systems for Parker Hill Fenway GNRP Area, Mass. R-48", to Boston Redevelopment Authority, by Charles A. Maguire & Associates, 1963

89. "Contractor's View on Unlined Tunnels", by A.M. Petrofsky, Proc., ASCE, Jour., Power Division, PO-3, Paper No. 4086, Vol. 90, 1964

90. "Pollutional Effects of Stormwater and Overflows from Combined Sewer Systems, (A Preliminary Appraisal)", U.S. Department of Health, Education & Welfare, Public Health Service, No. 1246, 1964

91. "Two to Ten-Day Precipitation for Return Periods of 2 to 100 Years in the Contiguous United States", Weather Bureau Technical Paper No. 49, 1964

92. "Tidal Datum Planes and Related Problems", by W. Shofnos, Office of Oceanography, Coast & Geodetic Survey, 1964

93. "Bedrock Valleys of the New England Coast as Related to Fluctuations of Sea Level", by Upson & Spencer, U.S. Geological Survey, Prof. Paper No. 454-M, 1964

94. "Scientific and Technical Applications Forecast-1964-Excavation", AD607077, U.S. Department Commerce, Office of Technical Services, prep. for Office of the Chief of Research & Development, Department of the Army, by Hughes Tool Company, 1964

95. "Study of Sewer and Drain Systems and Recommended Improvements (Washington Park Urban Renewal Area)", to Boston Public Works Department, by Fay, Spofford & Thorndike, 1964

96. "Report on Water and Sewer Systems-Inspection and Flow Measurements-South End Project - Mass. R-56", to Boston Redevelopment Authority, by Charles A. Maguire & Associates, 1964. (Appendix D, Inspection of Sewers - Data Sheets, bound separately)

97. "Report on Preliminary Studies of Existing Utility Systems", to Boston Redevelopment Authority, by Charles A. Maguire & Associates, 1964

98. "Status of Tunnel & Raise Boring", by R.J. Robbins, A.I.M.E., Paper No. 64, AU48, 1964

99. "Geology of the City Tunnel Extension, Greater Boston, Massachusetts", by M.P. Billings & F.L. Tierney, Jour., BSCE, Vol. 51, No. 12, 1964

100. "Renewal Program Traffic Study, Boston, Massachusetts", by Wilbur Smith and Associates, for Boston Redevelopment Authority, 1965,
    Part 1. Overall Circulation Plan
    Part 2. GNRP and Project Area Traffic Plans
    Part 3. Traffic Count and Street Inventory Studies

101. "Diversion and Treatment of Extraneous Flows in Sanitary Sewers", by L.W. Weller and M.K. Nelson, Jour., WPCF, Vol. 37, No. 3, 1965

102. "Report on Hard-Rock Tunnelling Investigation", by R.C. Hirschfeld, for U.S. Department of Commerce, Contr. C-85-65, M.I.T. Dept. of Civil Engineering, 1965

103. "Engineering Report on the Preliminary Design of Project Improvements, South End Project, Mass. R-56, - Part 1, Application and Loan", to Boston Redevelopment Authority, by Charles A. Maguire & Associates, 1965

104. "Project Improvements Report, Code No. R-224, South End Project, Project No. Mass. R-56, Final Project Report, Part 1 of Application for Loan & Grant, Vol. 2 of 2, Project Improvements, Water Distribution-Sewerage-Police & Fire Alarm-MBTA Facilities-Traffic Control-Signs", to Boston Redevelopment Authority, by Charles A. Maguire & Associates, 1965

105. "Summary 1965/76 General Plan for the City of Boston and the Regional Core", by Boston Redevelopment Authority, 1965

106. "Report on Preliminary Design, Marginal Pollution Control Project, Eastchester Bay, Vol. 1 - Report", to Department of Public Works, City of New York, by Greeley and Hansen, 1965

107. "Protecting the Potomac at Washington", by D.V. Auld, Jour., WPCF, Vol. 37, No. 3, 1965

108. "Machine Tunneling on Missouri River Dams", by L.B. Underwood, Trans., ASCE, Vol. 131, 1965

109. "Design, Construction and Proposed Operation of a Flooded Tunnel Interceptor System for the Metropolitan St. Louis Sewer District", by W.G. Shifrin, G.K. Hasegawa & V.C. Lischer, Jour., WPCF, Vol. 39, No. 3, 1967

110. "Effect of Storage & Skimming on Combined Sewage Overflows", by G.E. Hubbell, Preprint, WPCF, September 1966

111. "The Problem of Separation in Planning Sewer Systems", by T.R. Camp, Jour., WPCF, Vol. 38, No. 12, 1966

112. "Pollution Control Measures for Stormwaters and Combined Sewer Overflows", by D.D. Dunbar and J.G.F. Henry, Jour., WPCF, Vol. 38, No. 1, 1966

113. "Flood and Pollution Control, A Deep Tunnel Plan for the Chicagoland Area, A Prefeasibility Report", by Harza Engineering Company, and Bauer Engineering, Inc., Prep. for the Metropolitan Sanitary District of Greater Chicago under Federal Water Pollution Control Administration Research and Demonstration Grant, 1966

114. "Hydraulic Model Studies, Chlorination Mixing & Contact Chambers for the Calumet Treatment Plant", by Harza Engineering Company to Metropolitan Sanitary District of Greater Chicago, 1966

115. "Report to Board of Selectmen, Town of Brookline, Massachusetts, on Additions and Improvements to the Sewerage and Drainage Systems", by Metcalf & Eddy, 1966

116. "Report to City of Boston on 9-ft x 13-ft Interceptor Sewer (Dorchester Brook Interceptor) Adjacent to Boston Edison Building at Massachusetts Avenue", by Penetryn System, Inc., 1966

117. "Basic Design Report - Southwest Expressway - Interstate Route 95 - Route 128, Canton, to Jackson Square, Boston", by Brown Professional Engineers, Inc., 1966

118. "Geology of the Malden Tunnel, Massachusetts", by M.P. Billings and D.A. Rahm, Jour., BSCE, Vol. 53, No. 2, 1966

119. "Storm Detention and Chlorination Station, Supplemental Information, Facilities Demonstration Grant", by Metropolitan District Commission for Federal Water Pollution Control Administration, Department of the Interior, 1966

120. "Bacterial Effect of Combined Sewer Overflows on the Detroit River", by R.J. Burm, Jour., WPCF, Vol. 39, No. 3, 1967

121. "Underflow Sewers for Chicago", by M. Pikarsky & C.J. Keifer, "Civil Engineering", ASCE, Vol. 37, No. 5, 1967

122. "ASCE Project on Combined Sewer Separation", American Society of Civil Engineers for Federal Water Pollution Control Adminstration, reports by M.B. McPherson, 1967

123. "Ocean Outfall Design for Economy of Construction (Los Angeles County)", by J.D. Parkhurst, L.A. Haug & M.L. Whitt, Jour., WPCF, Vol. 39, No. 6, 1967

124. "Hypochlorination of Wastewater Effluents", by S.W. Steffenson and N. Nash, Jour., WPCF, Vol. 39, No. 8, 1967

125. "Response to Pollution of New York Harbor and Thames Estuary", by W.N. Torpey, Journal Series, N.J. Agricultural Exp. Sta., Rutgers Univ., 1967

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